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Draft Environmental Impact Statement of the Southwest Jemez Mountains Landscape Restoration Project

Santa Fe National Forest, Sandoval County, New Mexico

Cover: Four images showing differing photos of ponderosa pine trees; 1) trees are same size with little vegetation growth; 2) cut trees; 3) stand of mixed sizes, ages, and vegetation growth; 4) well-spaced trees.

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Southwest Jemez Mountains Landscape Restoration Project Draft Environmental Impact Statement Sandoval County, New Mexico

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Abstract: The Santa Fe National Forest proposes to conduct restoration activities over an 8-10 year period or until objectives are met. Five alternatives were considered in detail. Alternative1, the Proposed Action, would complete forest and watershed restoration activities including mechanical treatments and prescribed fire on a portion of the 110,000 acre Southwest Jemez Mountains Restoration Project area. Alternative 2 proposes no action; there would be no changes in current management. Projects approved by other environmental analysis and decisions would be implemented. Under Alternatives 3, 4, and 5, the mechanical treatments and/or prescribed fire would take place on fewer acres than the Proposed Action, Alternative 1. All action alternatives include other activities that would improve soil and watershed function, improve wildlife and aquatic habitat, and protect cultural resources. All action alternatives require site-specific, nonsignificant forest plan amendments. Transportation system changes would allow for access to treatment areas and include road maintenance or reconstruction, road decommissioning, temporary road construction (alternatives 1, 4, and 5 only), and development of gravel pits.

How to Comment: 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 final 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: Chris Napp
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11 Forest Lane
Santa Fe, NM 87508

Comments may also be submitted using the online comment system. Please see the cover letter for information on how and where to submit comments. Comments must be received no later than 45 days from the date of publication of the notice of availability in the Federal Register.

The comment period ends 45 days following the date of publication of the notice of availability of the draft environmental impact statement in the Federal Register. A legal notice will be published in the *Albuquerque Journal* and posted on the **Santa Fe National Forest Web site** within 4 days of publication in the Federal Register.

The date of publication in the Federal Register is the exclusive means for calculating the time to submit comments on this draft EIS. Those wishing to comment should not rely upon dates or timeframes provided by any other source. We expect the notice of availability to be published on or around February 28, 2014.

Those who submit comments during the comment period will be eligible to object to the decision. To be eligible to object, each individual or representative from each organization submitting comments must either sign the comments or verify identity upon request. Comments must meet the requirements of 36 CFR 218 subparts A and B.

Summary

The Santa Fe National Forest proposes to conduct treatments that would restore the structure and function of forests and watersheds across approximately 110,000 acres of the Jemez Ranger District. This work would be done over 8-10 years or until objectives are met. The purpose of the project is to restore ecosystem structure and function and increase resilience to undesirable, large-scale disturbances such as high-severity wildfire, climate change, or insect outbreaks in the Southwest Jemez Mountains. To do this, we have identified four purposes:

- Restore the structure, function, and resilience of ponderosa pine and dry mixed conifer forests, which would also reduce the potential for uncharacteristically severe and intense wildfires while promoting low-intensity, frequent surface fires that were common across this landscape.
- Improve the function of riparian ecosystems and streams, and improve fish and wildlife habitat, vegetative diversity, and water quality.
- Provide for the sustainability of archaeological sites, traditional cultural properties, sacred sites, and forest resources and areas associated with traditional practices.
- Offset treatment costs and provide economic opportunity through wood product removal.

Ecosystem conditions in the Southwest Jemez Mountains are 'out of whack'; they do not meet and are not moving toward the desired conditions outlined in the Southwest Jemez Mountains Landscape strategy.

The forest ecosystems that dominate this area, primarily ponderosa pine and dry mixed conifer forests, are highly altered from natural conditions. Instead of forests with groups of trees of different ages and sizes, there is a dense, continuous canopy of young and mid-age, pole-size (5-12-inches diameter) trees. The forests are lacking mature and old-growth trees, aspen, and openings with understory grasses, forbs, and shrubs. In their current condition, a wildfire would likely burn through these forests with uncharacteristically high intensity and severity.

Riparian, meadow, and aquatic systems are also in a degraded condition and do not provide quality habitat for native wildlife species. Denuded stream banks and stream-road crossings add more sediment to streams. Streams have few meanders, pools, and riffles that provide quality habitat for fish. Meadows are shrinking in size because of invading conifers.

These conditions are the result of past intensive logging and grazing, road building, and fire suppression. The combined effects from these activities over the past 90-100 years have changed the forests, grasslands, and riparian areas. They are degraded and have lost resiliency. These ecosystems are more susceptible to severe wildfires, insect and disease outbreaks, drought, and the effects of climate change.

The Proposed Action

To address these conditions, the Forest proposes to restore the landscape by mechanically treating forests, restoring meadows, using prescribed fire, and enhancing aspen stands. Other treatments would include invasive plant control, aquatic, riparian, and wildlife habitat improvement, and cultural resource protection.

Road treatments including maintenance, reconstruction, closing, and decommissioning roads, would decrease erosion and increase the resilience and function of soils, riparian areas, and watersheds. Temporary roads constructed to implement the restoration treatments, would be decommissioned upon project completion. New and existing gravel pits would be developed to provide gravel for the road work.

Twelve forest plan amendments are needed to achieve the purpose and need and to assure consistency with the Santa Fe forest plan. These are site-specific amendments and apply to this project only.

Public Involvement

The project was posted in the Santa Fe NF's schedule of proposed actions - and the notice of intent to prepare an environmental impact statement was published in the Federal Register on July 11, 2012 (Vol. 77, Issue 133). A draft proposed action was sent to a mailing list (hard copy and electronic mail) of individuals, organizations, Stage and local governments, Federal and State agencies, and tribes. During the spring and summer of 2012, we solicited comments on the proposed action through public meetings and field trips. Detailed information about these meetings can be found in the project record. A report summarizing the comments received was posted on the Santa Fe National Forest website in February 2012.

The interdisciplinary team reviewed the comments received during the public involvement period and used them to identify relevant issues. Four key issues were used to develop alternatives, develop design criteria or mitigation measures that reduce unwanted effects, and to evaluate, analyze and compare the effects of the different alternatives. These are:

- the use of prescribed fire, smoke, and their effects on the environment and human health;
- the scale of the area to be treated with mechanical treatments (tree cutting), and how this may affect watersheds, wildlife, and scenery;
- opening closed roads and building new temporary roads and their effects on the environment, and
- the effects of the mechanical treatments and prescribed fire on habitat for the Jemez Mountains salamander, Mexican spotted owl, and northern goshawk.

The interdisciplinary team also identified other comments as nonsignificant issues or concerns. Many of these concerns were considered and incorporated in the DEIS or design criteria, mitigations, and best management practices. Others were addressed in the environmental consequences. We also added more information about the proposed treatments and maps for each alternative. These and other changes that were made to the proposed action in response to public comments and interdisciplinary team discussions are listed in chapter 1 of the DEIS. Stakeholders have been and will be updated through our public involvement and consultation efforts.

What are the Alternatives?

Three alternatives were considered but eliminated from detailed study (see chapter 2) and five alternatives were evaluated in detail. The alternatives evaluated in detail are described below.

Alternative 1 - The Proposed Action

This alternative would mechanically treat approximately 29,900 acres of fire adapted ecosystems (ponderosa pine and dry mixed conifer) and use prescribed fire on approximately 77,000 acres.

Other restoration treatments for cultural resources, watersheds, and wildlife habitat are included in this alternative. See the list of other actions below. Site-specific forest plan amendments are needed to implement this alternative (see tables 1 and 2 in chapter 2).

Alternative 2 - No Action

This is the no action alternative as required by 40 CFR 1502.14(c). There would be no changes in current management and the forest plan would continue to be implemented. Alternative 2 is the point of reference for assessing action alternatives. This alternative would thin approximately 900 acres of ponderosa pine and dry mixed conifer and use prescribed fire on approximately 18,400 acres. Some other pre-approved activities, such as cultural resource protection, nonnative and invasive plant control, and wildlife habitat improvement projects would be implemented.

Alternative 3 - No Construction of Temporary Roads

This alternative responds to the issue of constructing new temporary roads to implement mechanical treatments. Only those areas accessed by existing forest system roads would be mechanically treated. Those acres not accessible by existing roads would be burned instead of mechanically treated, as in alternative 1. This alternative would mechanically treat approximately 28,300 acres of fire-adapted ecosystems (ponderosa pine and dry mixed conifer) and use prescribed fire on approximately 77,000 acres. Other restoration treatments for cultural resources, watersheds, and wildlife habitat are included in this alternative. See the list of other actions below. Site-specific forest plan amendments are needed to implement this alternative (see tables 1 and 2 in chapter 2).

Alternative 4 - No Prescribed Fire in Mechanical Treatment Areas

This alternative responds to the issues of smoke and the scale of prescribed fire. Prescribed fire would not be used in areas that are mechanically treated. The total area treated is the same as the proposed action. Instead of prescribed fire, slash resulting from mechanical treatments would be chipped or ground up (masticated), or lopped and scattered and left on site. Prescribed fire would occur in areas described as prescribed fire only under alternative 1. This alternative would mechanically treat approximately 29,900 acres of fire-adapted ecosystems (ponderosa pine and dry mixed conifer) and utilize prescribed fire on approximately 45,400 acres. Other restoration treatments for cultural resources, watersheds, and wildlife habitat are included in this alternative. See the list of other actions below. Site-specific forest plan amendments are needed to implement this alternative (see tables 1 and 2 in chapter 2).

Alternative 5 - Implement Restoration Activities While Complying with the Existing Forest Plan Standards and Guidelines for Managing Mexican Spotted Owl Habitat

This alternative was designed in response to issues raised regarding treatments in Mexican spotted owl (MSO) protected activity centers (PACs) and restricted habitat. The proposed forest plan amendments related to treatments in Mexican spotted owl habitat would not be needed to implement this alternative. This alternative would mechanically treat approximately 29,900 acres of fire-adapted ecosystems (ponderosa pine and dry mixed conifer) and use prescribed fire on approximately 76,300 acres. Other restoration treatments for cultural resources, watersheds, and wildlife habitat are included in this alternative. See the list of other actions below. Site-specific forest plan amendments, those not pertaining to the Mexican spotted owl, are needed to implement this alternative (see table 2 in chapter 2).

Actions Common to Alternatives 1, 3, 4, and 5

- Treatments in wet mixed conifer. Mechanical treatments would occur on approximately 1,150 acres. Areas prioritized for treatment include: areas close to endangered species habitat, wildland-urban interface areas, springs, areas with insects, disease, or other special needs, and small inclusions of wet mixed conifer within other cover types.
- Treatments to maintain or increase aspen. Mechanical treatments would occur on approximately 1,800 acres on slopes less than 40 percent. The treatments are intended to either maintain existing aspen stands or create new stands of aspen.
- Treatments in piñon-juniper. Trees would be thinned on approximately 1,000 acres to reduce erosion, protect heritage sites, or to increase habitat for songbirds.
- Treatments in Mexican spotted owl protected activity centers. Mechanical thinning treatments would occur on approximately 500 acres. The purpose of these treatments is to improve owl habitat and move stands toward having larger trees and a multi-storied canopy.
- Treatments for old growth. The mechanical treatments would aim to increase tree growth and size, create down wood and uneven-aged stands, and reduce loss of these stands in a wildfire.
- Treatments for maintaining or increasing meadow habitat. Cut trees from around meadow margins. This would occur on approximately 5,500 acres: 2,500 acres in the uplands and 3,000 acres in riparian areas.
- Treatments to enhance seeps and springs. Cut trees within 100 feet of identified seeps or springs conifer to improve water flow. This would occur on approximately 200 acres.
- Treatments to reduce erosion effects from headcuts**.** Fill headcuts with soil, rock, or boulders, or areas would be recontoured. Areas would be seeded with native grasses afterwards.
- Treatments to enhance native riparian vegetation and restore areas damaged by dispersed recreation. There are approximately 150 inventoried campsites that need restoration. Close sites by placing soil, rocks, and boulders on and around the site and by planting native vegetation. Exclosures may be used to protect newly planted vegetation.
- Treatments to restore instream habitat**.** Use heavy machinery to create pools and channels, replace culverts, and place or remove log and rock stream structures on selected locations along the 24 miles of perennial streams in the project area.
- Control of nonnative and invasive plants. Pull weeds, use prescribed grazing or prescribed fire, and methods other than herbicides to control populations of nonnative and invasive plants.
- Screen water sources from human disturbance. Plant trees and shrubs to screen tanks and drinkers from road viewpoints. Newly planted vegetation would be protected with fencing.

- Increase water availability for wildlife**.** Construct earthen dams or trick tanks. This would occur in the upper portions of watersheds and drainage headwaters throughout the project area.
- Create snags for wildlife habitat. Trees would be killed by burning or other means.
- Reduce risk of loss or damage to cultural sites. Remove trees and brush from approximately 3,000 known cultural sites in the project area to reduce the risk of loss or damage by wildfire.
- Implement road maintenance activities in the project area. Construct and/or improve of drainage features such as grade dips, lead-out ditches, roadside ditches, drainage crossings, and culverts and install erosion control treatments such as riprap, geotextile materials, and sediment basins.
- Provide gravel for road maintenance and improvement work. Up to five gravel pits and access roads would be developed to provide gravel for road maintenance and improvement work.
- Open existing closed roads and construct new temporary roads. Reopen and/or reconstruct approximately 20 miles of existing closed roads to provide access and product removal. In addition to these roads, approximately 12 miles of temporary roads would be constructed. All temporary roads would be decommissioned after use. No temporary roads would be constructed under alternative 4.
- Road decommissioning treatments. Approximately 100 miles of road in the project area have been identified as candidates for decommissioning. Methods for include installing signs, blocking entrances, restoring vegetation, eliminating the roadbed, and other methods described in Forest Service Manual (FSM) 7734.1. Roads causing damage to hydrological resources, cultural resources, or threatened, endangered, and sensitive species habitat are a priority for decommissioning.

Amendments for alternatives 1, 3, and 4

- Allows prescribed fire in Mexican spotted owl core areas.
- Allows treatments in 20 percent of the MSO protected activity centers rather than 10 percent.
- Revises paired monitoring so that treatment may occur in all six PACs within the project area and better achieve desired conditions.
- Revises treatment within MSO PACs to allow cutting trees up to 18-inches diameter, mechanical fuel removal, and prescribed fire to treat fuel accumulations to abate fire risk.
- Adjusts requirements for nest/roost characteristics in recovery habitat to guidance from the 2012 Mexican spotted owl recovery plan (USFWS 2012).
- Remove language specifying the use of thinning from below. Allows for the removal of intermediate size class trees for uneven-aged management.

Amendments for alternatives 1, 3, 4, and 5

- Allows treatments to occur during the northern goshawk breeding season.

- Adds language to allow for interspaces between vegetative groups in northern goshawk habitat.
- Removes restrictions for turkey nesting areas to allow for treatments to occur within the breeding season.
- Revises the forest plan direction for peregrine falcon management.
- Revises forest plan direction regarding scenery management within the Jemez National Recreation Area.

What are the Major Conclusions of the Environmental Analysis?

All action alternatives, to varying degrees, would meet the purpose and need by moving the forest towards the desired conditions to restore ecosystem structure and function and increase resilience to undesirable, large-scale disturbances such as high-severity wildfire, insect outbreaks, or climate change in the Southwest Jemez Mountains.

Alternative 1, the proposed action, , would improve tree growth, water absorption and infiltration, and increase the diversity and abundance of understory vegetation by reducing tree density and opening up the forest canopy. Other treatments would improve water quality by reducing the amount of sediment in streams.

Soil and watershed conditions would be also improved. Forest stands would vary in density, providing improved habitat for the Mexican spotted owl and species such as the northern goshawk that prefer open forests. Habitat for the Jemez Mountains salamander and the owl would be better protected against an uncharacteristically severe wildfire.

There would be short-term negative affects during or immediately after treatments, including soil disturbance and sedimentation to streams as well as impacts on grazing, visual quality, and recreation use. Forage availability for livestock grazing would be reduced over the short term, and some grazing permittees might see a reduced income from grazing. Human health would be affected by smoke from prescribed burning; these effects are also short term. Some threatened, endangered, and proposed species and their habitats would be adversely affected in the short term, but over the long-term, habitat conditions would improve and be more resilient to uncharacteristically severe wildfire.

Under alternative 2, the no action alternative, none of the proposed restoration treatments would be implemented. Current conditions and trends in this area would continue. The area would be at risk for an uncharacteristically severe fire, like the Cerro Grande or Las Conchas fires.

There would be no change at the landscape level to forest structure or composition, the amount of live and dead fuels, or the amount of understory vegetation. Archaeological sites would be adversely affected by roads, heavy fuel loads, and wildfire and suppression and rehabilitation activities. Wildlife habitat would decline in quantity and quality. Adverse impacts on sensitive species, management indicator species, and migratory bird populations, and destruction of habitat from a severe wildfire is likely. Water quality would not improve. Ecosystems would continue to have limited resilience to adapt to or survive and recover from potential large-scale disturbances such as uncharacteristically severe wildfire or climate change.

Alternative 3 would have effects similar to alternative 1, except 1,900 fewer acres would be mechanically treated. These areas would be treated with prescribed fire only. Without the benefits of mechanical treatments, fuel loads would be higher and the effects of prescribed fire on soils, vegetation, wildlife habitat and cultural sites could be more severe than under alternative 1. Treatments would be completed without building 12 miles of temporary roads and reopening an additional 11 miles of existing closed roads.

Alternative 4 would have effects similar to alternative 1, except fewer acres would be treated with prescribed fire. Slash from mechanical treatments would be chipped or ground up (masticated), or in some areas, left on site (lopped and scattered). Air quality, as measured by carbon dioxide and particulate emissions would be reduced by 44percent and 39 percent when compared to alternative 1. In addition, a wildfire burning in the untreated areas would burn at a higher intensity. Effects on soil, watersheds, wildlife habitat, cultural sites and other resources would be more severe on these acres than under alternative 1. The ecological benefits of prescribed fire would not occur on about 32,000 acres.

Alternative 5 would have effects similar to alterative 1, except within MSO PACs and core areas. In order to comply with the forest plan, approximately 700 acres would need to be excluded from prescribed fire. Treatments within the MSO PACs and other restricted habitat would meet the standards and guidelines of the current Santa Fe forest plan. While this would reduce adverse effects on the Mexican spotted owl in the short term when compared to the other action alternatives, the PACs and other restricted habitats would be less resilient to disturbance or other threats.

What is the Decision to be Made?

The Santa Fe National Forest supervisor is the Forest Service responsible official. Based on the environmental analysis and supporting documents in the project record, the forest supervisor will decide whether or not the proposed action should be implemented as proposed, modified by another action alternative, or not implemented at all, and whether to amend the forest plan. The decision includes determining 1) the location and treatment methods for all restoration activities; 2) design criteria, mitigation, and monitoring requirements; 3) the components that will be included in the monitoring plan; 4) the estimated products or timber volume to make available from the project; and 6) whether the forest plans will be amended if an action alternative is chosen. This decision is subject to the administrative review process under 36 CFR 218, subparts A and B.

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Chapter 1. Purpose of and Need for Action

About This Document

We have prepared this environmental impact statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This environmental impact statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

Additional documentation, including more detailed analyses of project area resources may be found in the project planning record at the Santa Fe National Forest Supervisors Office.

Chapter 1 includes information on the history of the project proposal, the purpose of and need for the project, and our proposal for achieving that purpose and need. This section also explains how we informed the public of the proposal and how the public responded.

The Proposed Treatments

We propose to carry out forest management treatments designed to restore ecosystem structure and function and increase resilience to disturbances such as uncharacteristically severe wildfire, climate change, or insect and disease outbreaks. The treatments include mechanical treatments; prescribed fire; meadow and riparian area restoration; enhancing aspen stands, cultural resource protection; invasive plant control; and aquatic, riparian, and wildlife habitat improvement. Road treatments include road maintenance, road decommissioning, gravel pit development and construction of temporary roads. Treatments would occur for 8 to 10 years or until desired conditions are met.

What are ecosystem structure, function, and resilience? What do we mean by restoration?

Restoration is the "process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystem sustainability, resilience, and health under current and future conditions." (Forest Service Manual 2020.5)

Ecosystem structure is the physical features that make up an ecosystem including the abundance and diversity of plant and animal species. In forest ecosystems, this is horizontal and vertical distribution of the vegetation of a forest stand, including the height, diameter, crown layers, and stems of trees, shrubs, herbaceous understory, snags, and down woody debris.

Ecosystem function is the interactions between organisms (plants, animals, microbes) and the physical environment, such as nutrient cycling, soil development, water cycling, and flammability.

Resilience is the "ability of a social or ecological system to absorb disturbance while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change." (Forest Service Manual 2020.5)

Location and Description of the Project Area

The project area covers about 110,000 acres of National Forest System land and is located in the Middle Jemez River Watershed (figure 1). The Valles Caldera National Preserve adjoins the project area on the northeast side; Bandelier National Monument lies to the southeast. A parcel of Jemez Pueblo land lies within the southeast part of the project area near Paliza Canyon.

The Village of Jemez Springs lies in the middle of the project area; Jemez Pueblo and the town of Ponderosa are 7 miles and 4 miles, respectively, to the south. There are also several small subdivisions and communities in the mountains around Jemez Springs, including Sierra de los Pinos, La Cueva, and Thompson Ridge. Other land ownerships within the project area boundary total 13,836 acres, broken down as follows: Jemez Pueblo (3,845 acres); State (281 acres), and private or other lands (9,710 acres). No treatments are proposed on these other lands.

The Jemez River flows through the middle of the area. Other drainages include San Antonio Creek, Rio Guadalupe, and Rio Cebolla. Elevations range from 10,109 feet at the top of Cerro Pelado to 5,500 feet in the canyon bottoms at the south end of the project area. Canyons and mesas dominate the area and include Virgin Canyon and Virgin, Holiday, Schoolhouse, and Stable Mesas to the west of the Jemez River, and Paliza and San Juan Canyons and Cat and San Juan Mesas to the east.

Ponderosa pine is the main forest type in the project area (48 percent), followed by piñon-juniper woodland (32 percent), mixed conifer (12 percent), and small patches of spruce-fir and aspen (less than 2 percent total) at higher elevations.

There are several special designation areas wholly or partially within the project area: East Fork Jemez Wild and Scenic River, Jemez National Recreation Area, Monument Canyon Natural Research Area, Jemez Mountain Trail Scenic Byway, and all or part of three inventoried roadless areas.

The project area and its resources are described in more detail in chapter 3, in the specialists' reports, and the Southwest Jemez Mountains Landscape Assessment (USDA Forest Service and VCNP 2010). The specialists' reports are found in the project record.

History of the Project

In 2000, the Cerro Grande Fire burned 48,000 acres and over 400 homes on forested lands just east of the project area. It also destroyed structures at the Los Alamos National Laboratory. After that wildfire, people from agencies, communities, conservation groups, and local and tribal governments teamed up to rehabilitate the fire-scarred land and to consider how to reduce the risk of uncharacteristically severe wildfires. The group met regularly for 10 years and completed a number of ecological assessments of the area. The assessments showed that the forests of the Southwest Jemez Mountains were not very resilient to landscape disturbances such as large-scale wildfires and were in need of restoration.

In 2009, Congress authorized the Collaborative Forest Landscape Restoration Program, which encouraged collaborative, science-based ecosystem restoration of forest landscapes. This is a competitive program that awards funding to the top proposals nationwide. The program provided a perfect opportunity for the Santa Fe National Forest and the key partners in the restoration group—Valles Caldera National Preserve (VCNP), Jemez Pueblo, The Nature Conservancy,

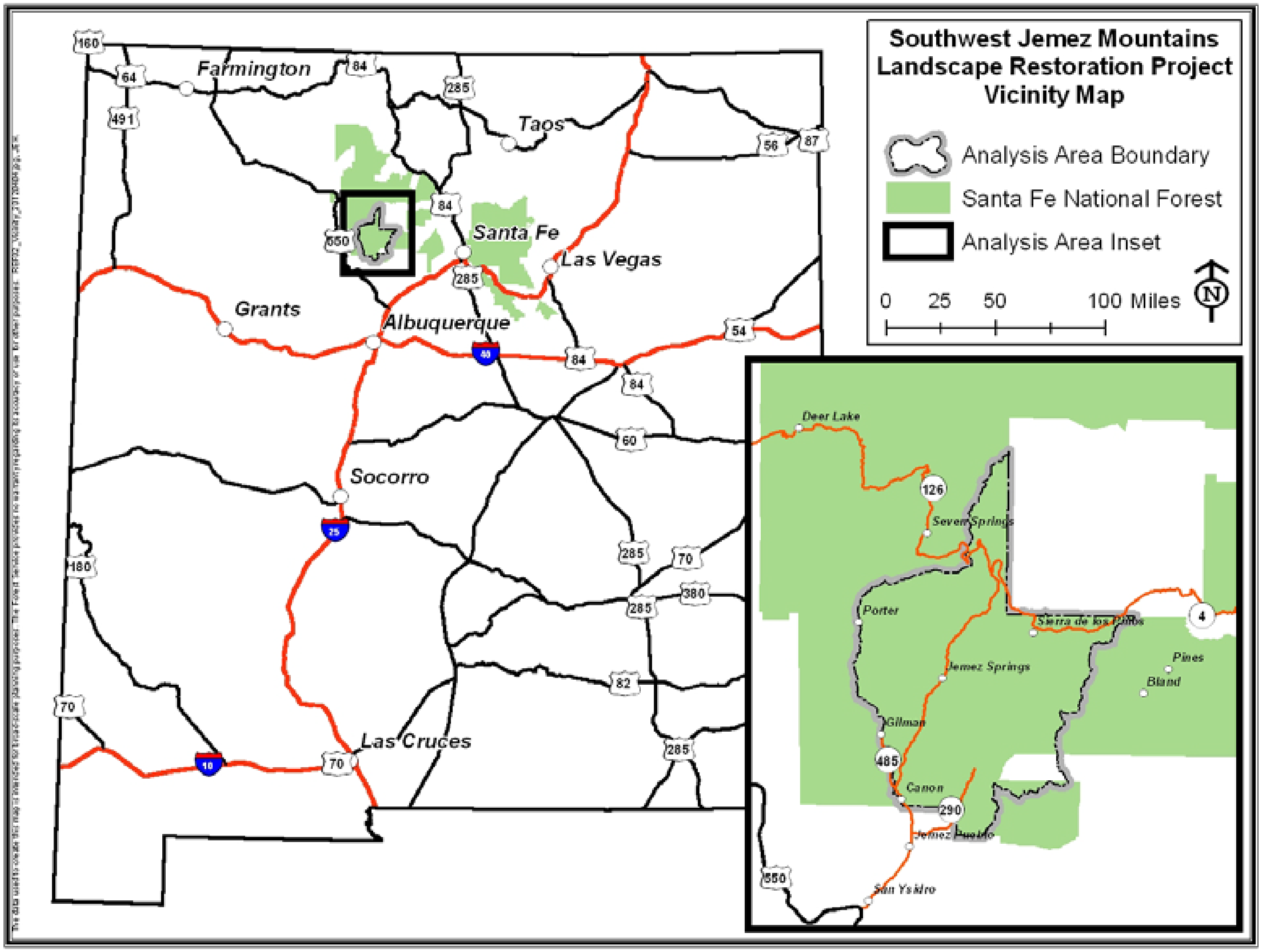

Figure 1. Vicinity map of the area. Jemez Springs is in the center of the project area. Valles Caldera National Preserve is the large white block in the upper right of the inset map.

New Mexico Forest and Watershed Restoration Institute—to develop a proposal and move forward on restoring the Southwest Jemez Mountains area. Over 40 agencies and groups met and developed the Southwest Jemez Mountains Collaborative Forest Landscape Restoration Strategy (USDA Forest Service and VCNP 2010) and "Out of Whack" reports. The group proposed to treat over 210,000 acres across multiple ownerships and integrate treatments for riparian and forest ecosystems, wildlife habitat, and cultural resources.

The Secretary of Agriculture selected the Southwest Jemez Mountains Landscape Restoration proposal in the first round of funding awarded in 2010. Since then, the partners have purchased monitoring equipment and started "shovel-ready" projects already analyzed under National Environmental Policy Act (NEPA) requirements.

Why Here, Why Now?

These restoration treatments are needed because current forest conditions are not as resilient to large-scale disturbances as they used to be. In other words, they do not easily recover from events such as wildfires, floods, or insect and disease outbreaks. Southwestern ponderosa pine forests have been studied intensively and we have good information about reference conditions (Cooper 1960; Covington and Moore 1994; Moore et al. 2004). There are also numerous studies on the forest conditions and fire cycles specific to the Jemez Mountains (Allen 1989, 2001; Touchan et al. 1995, 1996; Allen et al. 1995; Touchan and Swetnam 1995; Swetnam and Baisan 1996). From this and other research we know that current conditions are the result of past human activities starting in the late 1800s, including logging, grazing, and fire suppression. The combined effects from these activities have changed the forests, grasslands, and riparian ecosystems.

The U.S. Southwest, including the Jemez Mountains, has been the focus of ecological research on forest ecosystems, fire history and behavior, climate change, hydrologic regimes, and wildlife. The ecosystem changes in the Southwest Jemez Mountains have been documented in numerous landscape and resource assessments produced by land management agencies and conservation groups. These assessments identify the area as a critical conservation area and rank it as a top priority for restoration.

Existing and Desired Conditions: What We Have and What We Want

The description of the existing conditions in the project area is based on surveys, inventories, and other field work completed by Forest Service staff; Forest Service resource databases; scientific literature; and broad-scale resource assessment reports, including the Landscape Assessment (USDA Forest Service 2010). These references and detailed descriptions of the existing condition and the changes caused by human activities are summarized in this section. Full information can be found in the specialists' reports, located in the project record.

Forests and Woodlands

The forests we have today do not resemble the forests that existed before the late 1800s. This is especially true for the ponderosa pine and dry mixed-conifer forests. Logging, grazing, and fire suppression have changed the forests to the point where they are "out of whack"—that is, they do not function in a way that allows them to recover from disturbances such as wildfires, insect and disease outbreaks, and overall be more resilient to long-term changes in climate.

The desired conditions for this area come from a number of sources, including the Santa Fe National Forest Plan (hereafter referred to as the "forest plan") and ecological research on reference conditions.[1] Our desired conditions are more than just attempting to duplicate reference conditions. Reference conditions act as a baseline for evaluating current conditions, and they also guide the development of treatments (Fulé et al. 1997). Ecosystems function best in the conditions to which they adapted over time (Swanson 1994). For example, open forests, a grassy understory, and low-intensity surface fires are the key features of ponderosa pine forests. Moving the ponderosa pine forests toward these conditions increases resilience and the forests will be better equipped to handle disturbances, including climate change (Fulé 2008).

Ponderosa Pine and Dry Mixed Conifer Forests

Of all forest types in the project area, change within the ponderosa pine has been dramatic. These systems have moved from open forests dominated by groups and clumps of trees of different ages and sizes to a dense, continuous blanket of even-aged (80- to 90-year-old), pole-sized (5 to 12 inches diameter) trees (figure 2). Tree densities have increased 10-fold, from an average of 15 to 56 trees per acre to 500 trees per acre. There are fewer large trees (over 18-inches diameter), old-growth trees, snags, and down wood. Openings and understory plants are scarce.

Figure 2. Dense stand of ponderosa pine in the project area. The trees are a similar age and size. There is little or no understory vegetation. Much of the ponderosa pine forest in the project area looks like this.

The dense tree canopy also inhibits the growth of understory grasses, forbs, and shrubs. Instead, there is a carpet of pine needles. Without surface fires to thin out the small trees, the number of

[1] Reference conditions typically refer to the state of an ecosystem before human influences. They provide a reference baseline of conditions that scientists can compare to current conditions.

trees is unnaturally high, averaging 500 per acre. This means there is more competition for light, water, and nutrients. On average, the trees are now smaller and grow more slowly.

Dry mixed-conifer forests (primarily Douglas-fir, ponderosa pine, limber pine, and aspen) are in a similar state. These dense stands have more white fir and less aspen and ponderosa pine. There are fewer openings in the canopy and understory grasses and other plants are less productive and less diverse. Snow and rain are caught in the canopy and evaporate before reaching the ground.

Our desired condition for ponderosa pine is to have a mix of tree sizes and ages, including old growth (figure 3). Trees would be found mostly in unevenly spaced groups of 4 to 20 trees across the landscape. Interspaces, or openings, would be found between the groups of trees. This is often described as a mosaic. Desired conditions for dry mixed-conifer forests are similar, except that the groups of trees would be denser and spaces between the groups would be smaller. In both types, the openings provide places for seedlings to sprout and grow.

Figure 3. This is a good example of our desired conditions for ponderosa pine. There are three age and size classes of trees: older, large diameter trees on the left, sapling and seedlings at the center and right front, and pole size trees in the background. A mix of grasses and nonwoody plants makes up the understory.

With more open stands, fire could play its key role in maintaining both types of forests. Low-intensity surface fires would reduce or maintain fuel levels and tree densities and rejuvenate the understory bunchgrasses.

Aspen and Piñon-juniper Forests

Aspen is dependent on disturbance (fire and windthrow) for regeneration. Due to a lack of periodic fires that historically regenerated patches of aspen, most of the aspen is mature or over-mature. Conifer trees are taking over the aspen patches due to the lack of natural fires, resulting in a gradual loss of aspen stands. Without fire or other disturbance, aspen stands in the area will gradually die out as they are replaced by conifers.

We want to maintain the aspen we have and regenerate more stands on the west side of the project area for vegetative diversity. Aspen stands will also enhance wildlife habitat and provide visual diversity.

Piñon-juniper forests have also changed since the late 1800s. Livestock grazing reduced the amount of grasses and ground cover that provided fuel for fires. This encouraged the growth of more piñon pine and juniper trees because of reduced competition from grasses and increasing bare soil. Currently, tree density is high, there is very little understory vegetation, and soil erosion is common (figure 4).

Figure 4. Piñon-juniper is found in the southern part of the project area. There is little or no understory vegetation. Large areas of bare soil are easily eroded.

In piñon-juniper forests, we want an understory that provides forage and habitat for wildlife such as turkey, deer, rodents, and small birds. Having more ground cover would also reduce erosion in this forest type.

Wet Mixed Conifer

This forest type has experienced the least amount of human-influenced change. There are dense stands of trees of all ages and sizes. Douglas-fir and white fir are the main species, and there is usually some remnant aspen in the understory. Large and small openings in the canopy have been created by fire and other disturbances.

Our desired condition is to have a mix of tree species and tree sizes and ages in patches across the landscape. This will provide a diverse habitat for threatened and endangered species. We also want a lower density of trees in some areas to reduce fire hazard in Mexican spotted owl habitat and near wildland-urban interface areas.

Old Growth

Old growth (also called late successional stage or climax forest) is critical to maintaining the biological diversity and abundance of many species of native plants and animals. In the Southwest Jemez Mountains, important species include the Mexican spotted owl and the Jemez Mountains salamander (figure 7). The project area has not been fully inventoried for old growth, but there are large, mature trees throughout the area. However, these large trees are not uniformly distributed and occur mostly on steep slopes or in canyon bottoms. The mesa tops exhibit a similar long-term decline in old growth forest that has occurred throughout the Southwest U.S. in general.

We want to allocate 20 percent of both ponderosa pine and mixed conifer forests as old growth. Our desired condition is for these areas to have snags, large trees, down logs, and thick-barked, fire-resistant species such as ponderosa pine and Douglas-fir across the landscape.

Meadows, Riparian Areas, and Aquatic Habitat

Grasslands and meadows are smaller than in the past because trees have spread into these areas (figure 5). This, along with increased numbers of trees overall, has altered the hydrology and function of wetland and riparian systems. As trees take up more water, there is less water in streams, seeps, and springs. Grazing, recreational use, and noxious nonnative and invasive species have reduced the abundance and diversity of native vegetation in meadows.

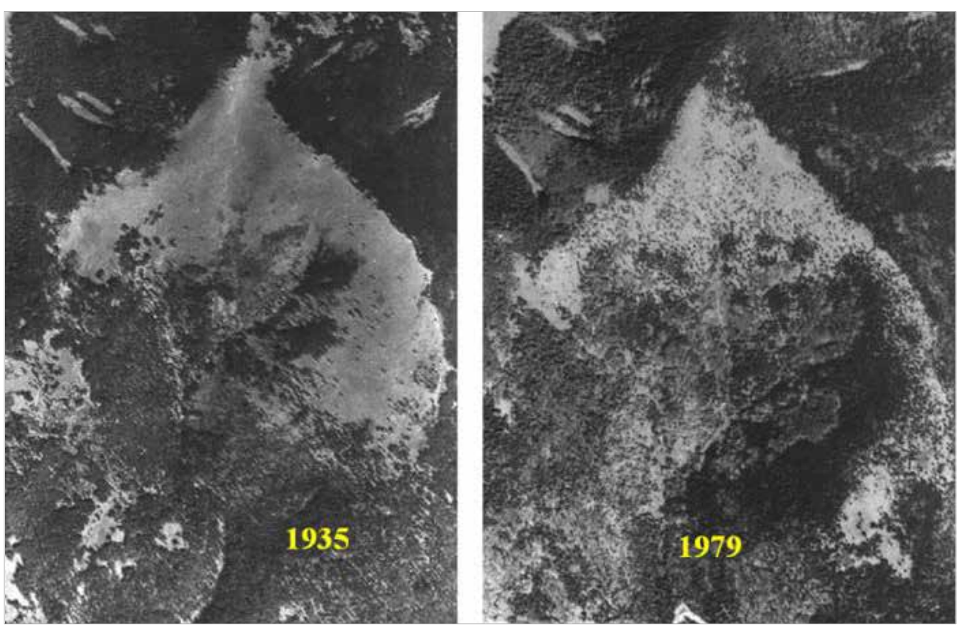

Figure 5. Aerial photographs of a typical Jemez Mountains ridgetop grassland in 1935 and 1979. Notice how the open meadow has become smaller because of invading conifers. Areas of open montane grasslands in the Jemez Mountains have declined by 55 percent because of conifer encroachment. Photos were taken 44 years apart.

In riparian areas, recreation use (camping, fishing, vehicle use), and grazing have trampled riparian vegetation and streambanks. These bare areas along streams, headcuts (gullies), and eroded streambanks add sediment to streams, impacting both water quality and fish habitat (figure 6). Some riparian corridors do not have enough willow, aspen, or other vegetation to sustain beaver populations. Some streams do not meet State water quality standards because of high sediment levels and high water temperatures. Fish habitat—riffles, pool depth and quality, amount of large woody debris, and streambank condition—is also in a degraded condition.

Figure 6. Degraded section of Rio Cebolla. The stream channel is entrenched (below the level of the meadow). Sections of the bank on the middle left and upper right are eroding.

Our desired condition is to have meadows that are more like historical natural meadows with abundant and diverse native vegetation. Hydrologic function would be improved, and springs and seeps would produce more water.

Aquatic habitats and riparian areas would be properly functioning, with abundant, diverse native vegetation that stabilizes streambanks and provides stream shading and cover for native aquatic species. Habitat for beaver, the New Mexico meadow jumping mouse, and threatened, endangered, and sensitive species would be restored and maintained. Riparian corridors would have habitat connectivity, and streams would have more pools, curves, bends, and woody debris. Sediment would be reduced and water quality would move toward or meet State standards.

Wildlife Habitat

Our concerns about wildlife habitat are related to current forest conditions. Because of the dense closed canopy forest there is a lack of understory plants that provide forage and cover for ungulates (elk and deer) and nesting habitat for small mammals and birds. Open meadow and aspen habitats are decreasing due to lack of periodic fires and the ingrowth of conifer trees. Nonnative and invasive plants (weeds) are impacting habitat by competing with native vegetation. The presence of roads, vehicle use, and human activity and noise also break up habitat and disturb wildlife.

Water is a vital component of high quality wildlife habitat, but it is not abundant or widespread across the landscape. Existing water sources are diminishing and are lacking in some parts of the landscape. Less rain and snowfall reach the ground because it is intercepted by the dense layer of trees, resulting in a loss of surface and ground water supplies. Springs and seeps that provided water for wildlife are now dry or have less water.

If we achieve our desired conditions for forest and woodland vegetation types, we would also achieve most of our desired conditions for wildlife habitat, which is to provide quality habitat for a wide variety of wildlife species. Across the landscape, we want forests to have trees of different ages and sizes and a diverse understory of grasses, forbs, and shrubs. Forests would also have more old and mature trees, snags, and large woody debris that provide nesting and sheltering habitat. Water sources, including streams, rivers, springs, and artificial water sources would be well functioning and distributed across the landscape. Habitat for the Mexican spotted owl and Jemez Mountains salamander would meet the requirements in the forest plan and the recovery plans for these species.

Threatened and Endangered Species

There are two listed threatened and endangered species within the project area: the Mexican spotted owl (threatened) and the Jemez Mountains salamander (endangered) (figure 7).

Figure 7. Mexican spotted owl (left) and Jemez Mountains salamander (right). (Photos courtesy of Charlie Denton, Apache-Sitgreaves National Forests and Valles Caldera National Preserve, respectively)

Current habitat conditions in the project area do not meet guidelines identified in the recovery plans for the owl (USFWS 1995, 2012) primarily due to the lack of structural and vegetative species diversity, large trees, and understory plants. The greatest threat to owl habitat in the project area is the high potential for an uncharacteristically severe wildfire like the Cerro Grande or Las Conchas Fires. Other key problems affecting the owl habitat in this area are the lack of large mature trees, and habitat for prey animals.

The scientific knowledge about the life cycle of the Jemez Mountains salamander and its habitat requirements is limited. It is thought the best habitat includes heavy tree canopy, large downed logs that provide cover and above ground habitat, and loose rocky soils where salamanders lay eggs. The primary threats to these salamanders are loss of habitat due to climate change, stand-replacing fires, and direct loss due to human activity (such as vehicle use and recreation). These threats interact in a complex way that could lead to local extirpation (loss) of salamanders at currently occupied sites (USFWS 2012).

Our desired condition for the habitat for both species is to make their habitats resilient to the effects of their primary threats.

Cultural Resources

The Jemez Mountains are rich in cultural resources from Native American, Hispanic, and Euro-American residence and use. There are nearly 3,000 known archaeological sites. Tribal members today use the area for hunting and gathering plants, boughs, and other materials for household and ceremonial use.

Currently, many sites in the area have high loads of forest fuels; trees and brush grow on and within sites, and dead and down logs are lying on top of walls and other features (figure 8). These sites have experienced and survived low-intensity surface fires for centuries, but now are at high risk of destruction in the event of an uncharacteristically severe wildfire. Heavy recreational use in the area has led to some instances of vandalism. In some places, unauthorized roads and trails and grazing have caused increased erosion within site boundaries.

Figure 8. An archaeological site before and after treatment. Left: Downed trees and logs on top of the rock structure will damage the site, especially if there is a severe wildfire. Right: After treatment, fuels are gone and the site is capable of withstanding a low-intensity surface fire.

Our desired condition for archaeological sites is to have reduced fuel levels so that they are resilient to the effects of an uncharacteristically severe wildfire, including the flooding and erosion that follow. The forest would continue to provide the resources for traditional communities that help preserve and sustain their traditional practices. Resilience would be provided, in part, by an abundance of native grasses that stabilize the soil and provide fine fuels (grasses) to carry low-intensity fires.

Roads

The project area has a lot of roads and many are in poor condition. Most are unsurfaced (no gravel), primitive dirt roads (maintenance level 2) with little or no functioning drainage features. Many are parallel to canyon bottoms and some cross stream channels, resulting in more sediment in the water. Overall, roads in poor condition contribute the most to loss of soil productivity and impacts on water quality. Roads also impact cultural resources, wildlife habitat, and contribute to the spread of invasive plants.

We want adequate and safe access to the project area to accomplish restoration treatments, to remove products, and for public use. This can be done by using existing National Forest System roads, opening National Forest System roads that are currently closed (maintenance level 1) and closing them after use, and constructing temporary roads that would be decommissioned[2] after use.

We also want a road system that does not degrade water quality, soils, watershed conditions, and other resources. Reconstructed and adequately maintained roads would have improved surfaces and drainage functionality that minimize erosion, sedimentation, and other resource impacts. Decommissioned roads would no longer significantly contribute to resource impacts.

Nonnative and Invasive Plants

To date we have identified about 1,200 acres of nonnative and invasive plants (weeds) in the project area. Nonnative and invasive plants outcompete and displace native plant communities. As invasive plant populations increase, more wildlife habitat is lost, especially in critical places such as riparian areas and valley bottoms. This is the case in the project area. Salt cedar, Russian olive and Siberian elm are found along the Jemez River and other low elevation streams. Throughout the Southwest, these wet areas are critical habitat for many plants and animals. With loss of this habitat, the abundance and diversity of wildlife species also declines. Numerous other invasive plant species are present in the area, and although they are not present in large acreages, they are still a concern in regards to decreasing vegetative diversity.

We cannot eliminate all the weeds across this landscape, but we desire to have a landscape with fewer weeds, more vegetative diversity, and quality wildlife habitat. We also want to reduce the potential for, and establishment and spread of, nonnative and invasive plant species infestations, especially in special plant and wildlife habitats and riparian areas.

Our Purpose and Need for this Project

The Southwest Jemez ecosystems are in a degraded condition and have lost resiliency (the ability to recover from a disturbance). They are now more susceptible to severe and intense wildfires, insect and disease outbreaks, drought, and climate change. Therefore, our overarching goal at the landscape level is to restore ecosystem structure and function and increase resilience to undesirable, large-scale disturbances such as uncharacteristically severe wildfire, insect outbreaks

[2] See description of decommissioning on page 20.

and climate change in the Southwest Jemez Mountains. To do this, we have identified four purposes:

Restore the structure, function, and resilience of ponderosa pine and dry mixed conifer forests, which would also reduce the potential for uncharacteristically severe and intense wildfires while promoting low-intensity, frequent surface fires that were common across this landscape.

To achieve this, there is a need for:

- forest stands with a mosaic of grassy openings, shrubs, and groups of trees of various sizes and ages;
- native perennial grasses, shrubs, and forbs that can carry low-intensity fire across the landscape;
- a landscape where fire can resume its role as an essential and keystone process;
- more old-growth forest structure in ponderosa pine and dry mixed-conifer stands, and
- reduced amounts of live and dead fuels.

Improve the function of riparian ecosystems and streams, and improve fish and wildlife habitat, vegetative diversity, and water quality.

To achieve this, there is a need for:

- native riparian vegetation along streams and more pools, riffles, and large woody debris within streams;
- aspen in a range of successional stages that are distributed across the landscape;
- fewer impacts from livestock and elk in riparian areas and along streambanks;
- less erosion, bare soil, and unstable or raw streambanks;
- less erosion and fewer headcuts and gullies in upland areas;
- fewer impacts from roads;
- fewer nonnative invasive plants;
- springs and seeps that function at or near their potential;
- more structural and understory diversity in northern goshawk and Mexican spotted owl habitat;
- less erosion overall, and therefore less sediment in streams;
- improved floodplain function;
- meadows restored to former boundaries to increase meadow habitat, and
- increased water availability for wildlife.

Offset treatment costs and provide economic opportunity through wood product removal.

To achieve this, there is a need for:

- a source of wood products for commercial and personal use;
- a transportation system to implement activities and remove wood products, and
- reduced fuel loading through the removal of forest products.

Provide for the sustainability of archaeological sites, traditional cultural properties, sacred sites, and forest resources associated with traditional practices.

To achieve this, there is a need for:

- reduced amounts of fuel on archaeological sites;
- erosion control measures on archaeological sites;
- forests that provide continued availability to engage in traditional practices; and
- fewer road-related impacts on archaeological sites.

The Proposed Action

The proposed action is designed to achieve the purpose and need with prescribed treatments to restore the structure and function of forests and watersheds in the project area. Treatments are briefly described below. The restoration treatments and the general locations are described in detail in chapter 2. Treatments will take place over the next 8 to 10 years or until objectives are met.

Restore the Structure, Function, and Resilience of Forests

- Mechanically treat (cut and remove) trees to reduce tree density and provide age and size class diversity within the stands.
- Use prescribed fire to create and maintain open conditions, restore natural fire, and reduce activity fuels.
- Enhance and promote aspen by cutting and removing conifers in areas with aspen.

Improve the Function of Riparian Areas and Streams, Vegetative Diversity, and Water Quality

- Plant trees, shrubs, and other plants to enhance native riparian vegetation.
- Close and revegetate degraded campsites and trails by placing soil, rock, and boulders on and around the site and by planting native vegetation.
- Place large woody debris and/or plant vegetation in or near stream channels to stabilize streambanks.
- Remove, obliterate, or improve road crossings at streams to reduce sedimentation.
- Fill headcuts and arroyos with soil, rock, or boulders to control erosion.
- Construct earthen dams or trick tanks in upland areas to increase water availability for wildlife and to improve fish and wildlife habitat.

- Plant trees and shrubs around water tanks and drinkers for wildlife to screen them from road viewpoints.
- Remove trees from around meadow margins to restore meadows and increase meadow habitat.
- Fence streamside areas to prevent access by livestock or elk and protect and increase streamside vegetation and overhanging streambanks from grazing and trampling.
- Place large woody debris and/or plant vegetation in or near stream channels to stabilize streambanks.
- Remove, obliterate, or improve road crossings at streams to reduce sedimentation.
- Create pools and channels, replace culverts, and replace or repair stream structures to restore instream fish habitat.
- Create snags.

Sustain and Protect Cultural Resources

- Use contour felling, lop and scatter, seeding and mulching, and placing limbs in erosion cuts and rills to control and prevent erosion on archaeological sites.
- Remove trees and brush from archaeological sites, traditional cultural properties, and sacred sites to reduce fuel.

Reduce Impacts from Roads

- Decommission up to 100 miles of unneeded roads, those NOT designated in the Forest’s travel management decision.
- Reconstruct and maintain existing Forest system roads used for project related access. This includes opening closed roads and closing them after use.
- Develop gravel pits to reduce surfacing costs. Gravel would be used to improve road surfaces thereby reducing erosion and maintenance costs throughout the area.

Access Treatment Areas and Remove Wood Products

- Construct temporary roads and decommission them after use.
- Reopen existing closed roads and close them after use.

Forest Plan Amendments, Permits, Licenses, and Consultation

Chapter 2 has a detailed discussion of the forest plan amendments needed for implementing the proposed action, as well as Federal permits or licenses and consultation needed.

The Decision to Be Made

The forest supervisor for the Santa Fe National Forest is the responsible official. Based on the environmental analysis and supporting documents in the project record, the forest supervisor will decide whether the proposed action should be implemented as proposed, modified by another action alternative, or not implemented at all, and whether to amend the forest plan. Their decision includes determining (1) the location and treatment methods for all restoration activities; (2) design criteria, mitigation, and monitoring requirements; (3) the components that will be included in the monitoring plan; (4) the estimated products or timber volume to make available from the project; and (5) whether the forest plan will be amended if an action alternative is chosen.

Public Involvement Efforts

We began public involvement efforts during the spring and summer of 2012. A timeline and description of these efforts is found in the project record.

We also sent letters to tribes and Pueblos with a historical link to the area and an interest in the Santa Fe National Forest to: Santa Clara Pueblo, Pueblo of Jemez, Pueblo of San Felipe, Navajo Nation, Jicarilla Apache, Mescalero Apache, Kewa Pueblo, San Juan Pueblo, Pueblo of Zuni, Pueblo of Cochiti, Pueblo of Pojauque, Pueblo of Picuris, Pueblo of Taos, Pueblo of Tesuque, and Pueblo of Zia. The Navajo Nation was the only tribe to submit a response and did not have any concerns with the project at that time.

Issues Identified From Public Comments

We reviewed the comments we received from all our meetings and notices and used them to identify relevant issues. Issues were used to develop alternatives, develop design criteria or mitigation measures that reduce unwanted effects, and to analyze and compare the effects of the different alternatives (see chapter 3). The interdisciplinary team identified several issues focused on:

- the use of prescribed fire and its effects on environmental and human health;
- the scale (too many acres) of tree cutting, the cutting of large trees and how this may affect watersheds, wildlife, and scenery;
- opening closed roads and building new temporary roads and their effects on the environment,
- the effects of mechanical treatments and prescribed fire on habitat for the Jemez Mountains salamander, Mexican spotted owl, and northern goshawk, and
- the need to do an amendment for Mexican spotted owl and whether it fails to protect the owl in the short term.

The interdisciplinary team identified some comments as nonsignificant issues or concerns. These were not studied in detail because they are (1) outside the scope of the proposed action; (2) already decided by law, regulation, forest plan, or other higher level decision; (3) not related to the decision to be made; or (4) conjectural and not supported by scientific or factual evidence. These issues and concerns and our reasons for categorizing them as nonsignificant are in the project record.

Concerns that Arose during Public Involvement

Other comments, concerns, and recommendations that were not considered key issues were raised during the public involvement effort and included:

- keeping Native American tribes, local communities, grazing permittees updated on planning and implementation;
- focusing on treating wildland-urban interface areas;
- using the best available science regarding Southwestern forest ecosystems;

- requests for more information about the restoration treatments and their location;
- the effects of tree cutting and prescribed fire on wildlife, including migratory birds;
- reducing the scale of treatments in aspen and piñon-juniper; and
- complying with law, policy, and regulation regarding health and the environment.

Many of these concerns were considered and incorporated in the DEIS or design criteria, mitigations, and best management practices. We added more information about the proposed treatments, as well as maps showing the locations of potential treatments for each alternative. Public involvement and compliance with existing laws are part of the NEPA process. Stakeholders have been and will be updated through our public involvement and consultation efforts. We have also hired implementation and partnership coordinators who have been working with the public. All stakeholders will have more opportunities to participate and comment as we develop the final environmental impact statement.

Comments regarding effects on wildlife, vegetation, or the environment were addressed in the environmental consequences. Some comments were beyond the scope of the project, such as the reintroduction of wolves or beavers to the area or restoration of the Las Conchas burn area, or focusing on wildland-urban interface areas. Stakeholders recommended additional scientific literature references and citations, which we reviewed and considered. We have also used recent research about aspen to review and adjust the proposed aspen treatments. We have also incorporated new research done in the Jemez Mountains, about severe wildfires and permanent changes to vegetation types into the environmental analysis. See the scoping report in the project record for our responses to all of the concerns.

Changes to the Proposed Action

After reviewing public comments received on the proposed action during July and August 2012, the interdisciplinary team made the following changes to the proposed action. These changes were reviewed and approved by the forest supervisor and included.

- Eliminating the treatment to remove Kentucky blue grass. This was too difficult and costly to implement and not likely to succeed.
- Eliminating the treatment to thin toe slopes and create woody debris. This was incorporated into the mechanical treatments.
- Correcting terms, definitions, mileage, and acreage as needed.
- Expanding the descriptions of the mechanical treatments, prescribed fire treatments, and other restoration activities
- Developing maps of the potential treatment areas
- Clarifying that new administrative use roads may be needed to access the gravel pits.
- Expanding the description of the adaptive management approach we are using to determine when and where to treat
- Developing design features and best management practices that will minimize adverse effects (see appendix A)
- Identifying additional permits, licenses, or consultation needed.

- Identifying additional site-specific forest plan amendments needed to implement treatments, including those regarding using prescribed fire in Mexican spotted owl habitat, scenery management, management of northern goshawk habitat, peregrine falcon site plans, timber activities in turkey nesting areas (see tables 1 and 2 in chapter 2)

Chapter 2. Alternatives, Including the Proposed Action

About this Chapter

This chapter describes and compares the alternatives for the Southwest Jemez Mountains Restoration Project and includes a map of each alternative considered. This comparison provides a clear basis for choice among options by the decision maker and stakeholders. Some of the information used to compare the alternatives is based upon the design of the alternative (e.g., acres burned) and some of the information is based upon the environmental, social, and economic effects of implementing each alternative (how well it achieves the purpose and need).

Forest Plan Consistency

Forestwide and management or geographic area-specific standards and guidelines have been incorporated into the design of alternatives 1, 3, 4, and 5 as shown in appendix A. Other applicable forest plan requirements that have been incorporated by resource area are in the resource specialist reports. With the proposed nonsignificant forest plan amendments (see tables 1 and 2 in this chapter), alternatives 1, 3, 4, and 5 are consistent with the Santa Fe National Forest Land and Resource Management Plan (forest plan). All proposed amendments are site-specific and are only applicable to this project.

The forest plan will be amended using the 1982 rule procedures as allowed by the transition language of the 2012 planning rule (36 CFR 219.17(b)(3), 2012 Planning Rule). All amendments are non-significant (FSM 1926.51). The report documenting the consistency of the action alternatives with the Santa Fe National Forest Land and Resource Management Plan (forest plan) is found in the project record.

The Alternatives

This is a landscape-level restoration project; we are analyzing a project area that is approximately 110,000 acres. We do not have complete information about all the conditions of every acre, but we do have enough data to make an informed decision about what kinds of treatments work best in certain conditions.

Instead of using local-level treatments, such as a stand prescription, treatments will be guided by landscape features (what we find on the ground). Examples of landscape features are cover types, slope, scenic sensitivity levels, or threatened and endangered species habitat.

Once a set of landscape features is identified, we would then identify the types of treatment tools or design criteria that we could use to treat those features. Then we would project the effects caused by these different kinds of tools. This approach provides flexibility and is known as the "toolbox" approach. This approach lets us account for imperfect information and adapt to changes in environmental conditions. We can also monitor effects of the individual and cumulative actions and make changes to the design criteria or mitigation measures if the effects differ from what we predicted. In this way, as landscape conditions vary, even within a vegetation type like ponderosa pine, the appropriate tool is applied to achieve the desired result. A tool that might be appropriate in one area may not be the right tool to use somewhere else.

So, as an example, as the implementation team works its way through a potential treatment area it encounters an area of ponderosa pine with slopes less than 40 percent, an uneven-aged structure, and that is not within a Mexican spotted owl protected activity center. The treatment design criteria or tool that would be applied would be uneven-aged mechanical selection cutting and prescribed fire. The design criteria would be different if an even-aged structure was encountered or if the area being looked at was within a Mexican spotted owl protected activity center.

The toolbox approach applies to all alternatives, except for no action. Before carrying out treatments, project leaders would carefully look at the specific area to be treated and select the appropriate treatment tool(s). Appendix A lists the design criteria or tools we anticipate using in different landscape conditions.

The interdisciplinary team used comments from the public and within the Forest Service along with modeling and field surveys to modify the proposed action[3] and formulate alternatives to the proposed action. The five alternatives analyzed in this draft EIS include:

- alternative 1, the proposed action
- alternative 2, no action
- alternative 3, no temporary roads
- alternative 4, no prescribed fire in mechanical treatment areas, and
- alternative 5, implement restoration treatments while conforming to the existing forest plan standards and guidelines for managing Mexican spotted owl habitat (Amendment 6, 1996).

Alternative 1 – Proposed Action

The intent of this alternative is to restore the structure and function of forests and watersheds in the project area as described in chapter 1. Proposed treatments to accomplish this are listed below. Maps showing the treatment locations are found in figure 9 through figure 13 on pages 25-29.

Uneven-aged Mechanical Selection Cutting with Openings and Prescribed Fire in Ponderosa Pine

These treatments are designed to restore the structure and function of the ponderosa pine forest. The result of this treatment would be an uneven-aged forest with groups of trees of various sizes and ages. Grassy openings and groups of shrubs would be interspersed with the groups of trees. This would occur on slopes less than 40 percent slope on approximately 23,000 acres. To achieve this goal, trees would be cut using chainsaws or other equipment (i.e., feller-bunchers). Cut trees would be skidded to the road to be removed as logs or chips. Prescribed fire would then follow the cutting to reduce fuel loading and help restore the ecological benefits of fire. Prescribed fire may be repeated every 5 to 10 years to maintain desired fuel loads.

Stand Improvement Thinning and Prescribed Fire in Ponderosa Pine

These treatments would occur on slopes less than 40 percent slope on approximately 1,500 acres in ponderosa pine stands. Stand improvement thinning is designed to improve tree growth, tree vigor, and create stand structure that will allow uneven-aged desired conditions in the future. This would occur in young, even-aged stands such as plantations, stands with dwarf mistletoe, areas

[3] Modification of the proposed action is allowed by Forest Service regulations 36 CFR 220.5(e)(1). Changes to the proposed action are documented in the project record.

along some prescribed fire control lines, and in remote stands and/or steep slopes. Logs generated during treatment would be removed and sold to a purchaser. After improvement thinning, we would use prescribed fire to reduce fuel loading and help restore the ecological benefits of fire. Prescribed fire may be repeated every 5 to 10 years to maintain desired fuel loads.

Uneven-aged Mechanical Selection Cutting with Openings and Prescribed Fire in Dry Mixed Conifer

These treatments would occur on areas having less than 40 percent slope angle on approximately 5,300 acres in dry mixed conifer stands. Mechanical treatments would help achieve uneven-aged desired conditions similar to the goshawk guidelines[4], but we would leave a higher stand density and smaller openings. Logs generated during treatment would be removed and sold to a purchaser. After treatments, we would use prescribed fire to reduce fuel loading and help restore the ecological benefits of fire. Prescribed fire may occur every 7 to 12 years.

Stand Improvement Thinning and Prescribed Fire in Dry Mixed Conifer

These treatments would occur on areas having less than 40 percent slope on approximately 80 acres of dry mixed conifer stands. As in the ponderosa pine, the thinning is designed to improve tree growth, tree vigor and create stand structure that will allow future uneven-aged desired conditions. We propose to use this type of thinning in young, even-aged stands, stands with light to moderate dwarf mistletoe, along some prescribed fire control lines, and in remote stands and/or on steep slopes. This treatment is similar to the stand improvement thinning for ponderosa pine, but more trees would be thinned because mixed conifer stands have a higher stand density. Logs generated during treatment would be removed and sold to a purchaser. After treatments, we would use prescribed fire to reduce fuel loading and help restore the ecological benefits of fire. Prescribed fire may occur every 7 to 12 years.

Landscape Prescribed Fire

Prescribed fire would be used on approximately 77,000 acres to reduce forest fuels and begin landscape restoration. This includes all mechanically treated areas described above plus the areas having greater than 40 percent slope (32,400 acres). Some thinning and limbing of trees would occur next to prescribed fire control lines, heritage sites, and other areas to reduce fire intensity.

Treatments in Wet Mixed Conifer

Mechanical treatments would occur on approximately 1,150 acres having less than 40 percent slope in wet mixed conifer stands. Material generated during treatment may be removed. Prescribed fire may occur only on a limited basis to meet other objectives such as fuels reduction. Areas prioritized for treatment include areas close to endangered species habitat; wildland-urban interface areas; springs; areas with insects, disease, or other special needs; and small inclusions of wet mixed conifer within other cover types.

Treatments to Maintain or Increase Aspen

Mechanical treatments (tree cutting and log removal) would occur on approximately 1,800 acres having less than 40 percent slope where aspen occurs. Prescribed fire may be used on a limited basis to meet other objectives. The treatments are intended to either maintain existing aspen

[4] The goshawk guidelines are found in appendix D of the forest plan.

stands or create new stands of aspen. Treatments to maintain aspen would be done in stands where aspen is dominant. Patch cuts would be used to create new aspen patches (5 to 40 acres) in stands where aspen is no longer dominant. This treatment would focus on stimulating new aspen stands on the north and west portions of the project area because the eastern portion is near the Las Conchas Fire and has a lot of new aspen.

Treatments in Piñon-juniper

Trees would be thinned on approximately 1,000 acres of piñon-juniper stands to reduce erosion, protect heritage sites, or to increase habitat for songbirds. The trees cut would be made available to the public for firewood. Prescribed fire would not be used; instead, cut material (slash) would be scattered to provide ground cover or it would be piled and burned.

Treatments in Mexican Spotted Owl Protected Activity Centers

Mechanical thinning treatments would occur on approximately 500 acres on slopes of less than 40 percent in Mexican spotted owl protected activity centers. The purpose of these treatments is to improve owl habitat and move stands toward having larger trees and a multi-storied canopy. Trees larger than 18-inches diameter would not be cut. Cut material generated during treatment may be removed. Prescribed fire may occur on a limited basis to meet other objectives such as fuels reduction. Nest areas would not receive mechanical treatments. Prescribed fire would be allowed to burn through nest areas.

Treatments for Old Growth

The forest plan calls for allocating 20 percent of each cover type within an ecosystem management unit as old growth, preferably in patches greater than 40 acres. For our analysis the entire project area will be considered an ecosystem management unit. Because our landscape treatments are generally limited to ponderosa pine and mixed conifer, we will only address old growth in these two forest types. Twenty percent each of the ponderosa pine and mixed conifer forest types would be managed as old growth. Stands would be mechanically treated if it would hasten their trajectory toward old-growth characteristics as defined in the forest plan. The mechanical treatments would aim to increase tree growth and size, create down wood and uneven-aged stands, and reduce wildfire hazard. Cut material generated during treatment may be removed. Stands within or next to Mexican spotted owl protected activity centers, northern goshawk post-fledging family areas, Jemez Mountains salamander locations, and visually-sensitive areas for old growth management would be prioritized for treatment. Trees larger than 24-inches diameter would not be cut.

Treatments for Maintaining or Increasing Meadow Habitat

These treatments would cut trees from around meadow margins. This would occur on approximately 5,500 acres: 2,500 acres in the uplands and 3,000 acres in riparian areas. This includes all meadow types: upland, lowland, and wet meadows. In some areas, this may include removing logs.

Treatments to Enhance Seeps and Springs

Within 100 feet of identified seeps or springs conifer trees would be cut to improve water flow. This would occur on approximately 200 acres. In some areas, this may include removing logs.

Treatments to Reduce Erosion Effects from Headcuts

These treatments would fill headcuts with soil, rock, or boulders, or areas would be recontoured. Afterwards, we would seed these areas with native grasses.

Treatments to Enhance Native Riparian Vegetation and Restore Areas Damaged by Dispersed Recreation

Approximately 150 inventoried dispersed campsites need restoration. Most of the work would be done along the Rio Cebolla, Rio Guadalupe, and East Fork Jemez River, although some sites may be treated along San Antonio Creek and the Jemez River. Sites would be closed by placing soil, rocks, and boulders on and around the site and by planting native vegetation. Exclosures may be used to protect newly planted vegetation.

Treatments to Restore Instream Habitat

To help restore instream habitat, we would use heavy machinery to create pools and channels, replace culverts, and place or remove log and rock stream structures on selected locations along 24 miles of perennial streams in the project area. Treatment locations include the Rio Cebolla, Rio Guadalupe, San Antonio Creek, East Fork Jemez River, and Jemez River.

Control of Nonnative and Invasive Plants

To control populations of nonnative and invasive plants, we would pull weeds, use prescribed grazing, use prescribed fire, and use methods other than herbicides. Use of herbicides may be authorized upon completion of the final environmental impact statement for the Invasive Plant Control Project for the Santa Fe and Carson National Forests.

Screen Water Sources from Human Disturbance

To screen tanks and drinkers from road viewpoints, we would plant trees and shrubs around them. Newly planted vegetation would be protected with fencing.

Increase Water Availability for Wildlife

To increase water availability for wildlife we would construct earthen dams or trick tanks. This would occur in the upper portions of watersheds and drainage headwaters throughout the project area.

Create Snags

To create snags for wildlife habitat, we would kill trees by burning or other means. Work would be done throughout project area in stands lacking large-diameter snags (greater than 16 inches) or in stands that do not meet forest plan standards for snag density.

Cultural Site Protection

There are approximately 3,000 known cultural sites in the project area. To reduce the risk of loss or damage by wildfire, we would remove trees and brush from sites. Sites on the National Historic Register and those eligible for the register would have priority for treatment.

Road Maintenance

Road maintenance activities in the project area would include constructing and/or improving drainage features such as grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts, and installing erosion control treatments such as riprap or geotextile materials, creating sediment basins, or other erosion control features. Road surfaces would be maintained and gravel would be replaced. This would be done on selected roads used to access treatment areas and remove material. Roads would receive maintenance as needed throughout the life of the project and beyond.

Open Existing Closed Roads and Construct New Temporary Roads

Approximately 20 miles of existing closed roads would need to be reopened and/or reconstructed to provide access and product removal. These roads would receive maintenance as needed throughout the life of the project or duration of the contract and would be closed after use. In addition to these roads, approximately 12 miles of temporary roads would be constructed. These temporary roads would also receive maintenance as needed throughout the life of the project or duration of the contract. All temporary roads would be decommissioned after use.

Road Decommissioning Treatments

These treatments would restore unneeded roads to a more natural state. Methods include installing signs, blocking entrances, restoring vegetation, eliminating the roadbed, and other methods described in Forest Service Manual (FSM) 7734.1. Approximately 100 miles of road in the project area have been identified as candidates for decommissioning. Roads causing damage to hydrological resources, cultural resources, or threatened, endangered, and sensitive species habitat are a priority for decommissioning.

Gravel Pits

Up to five gravel pits and access roads would be developed to provide gravel for road maintenance and improvement work. The maximum size of a single pit would not exceed 5 acres and access roads. Gravel pits would be located near existing system roads to minimize the need for road construction and no road would exceed one-half of a mile in length. No pits would be built in the inventoried roadless areas, the Jemez Wild and Scenic River Corridor, or within the Jemez National Recreation Area.

Forest Plan Amendments

Forest plan amendments are needed to implement the treatments. These amendments and the reasons needed for the change are found in tables 1 and 2. Other required permits, licenses, and consultation are described later in this chapter.

Maps Showing Potential Treatment Locations

Figure 9 through figure 13 show the potential locations of the treatments described above. Treatment locations will be guided by what we find on the ground, and some areas may need a different type of treatment or none at all. The last two maps, figure 12 and figure 13, show the location of treatments common to all action alternatives (1, 3, 4 and 5). These include treatments for headcuts, nonnative and invasive plants, meadows, riparian areas, aspen, and piñon-juniper forest.

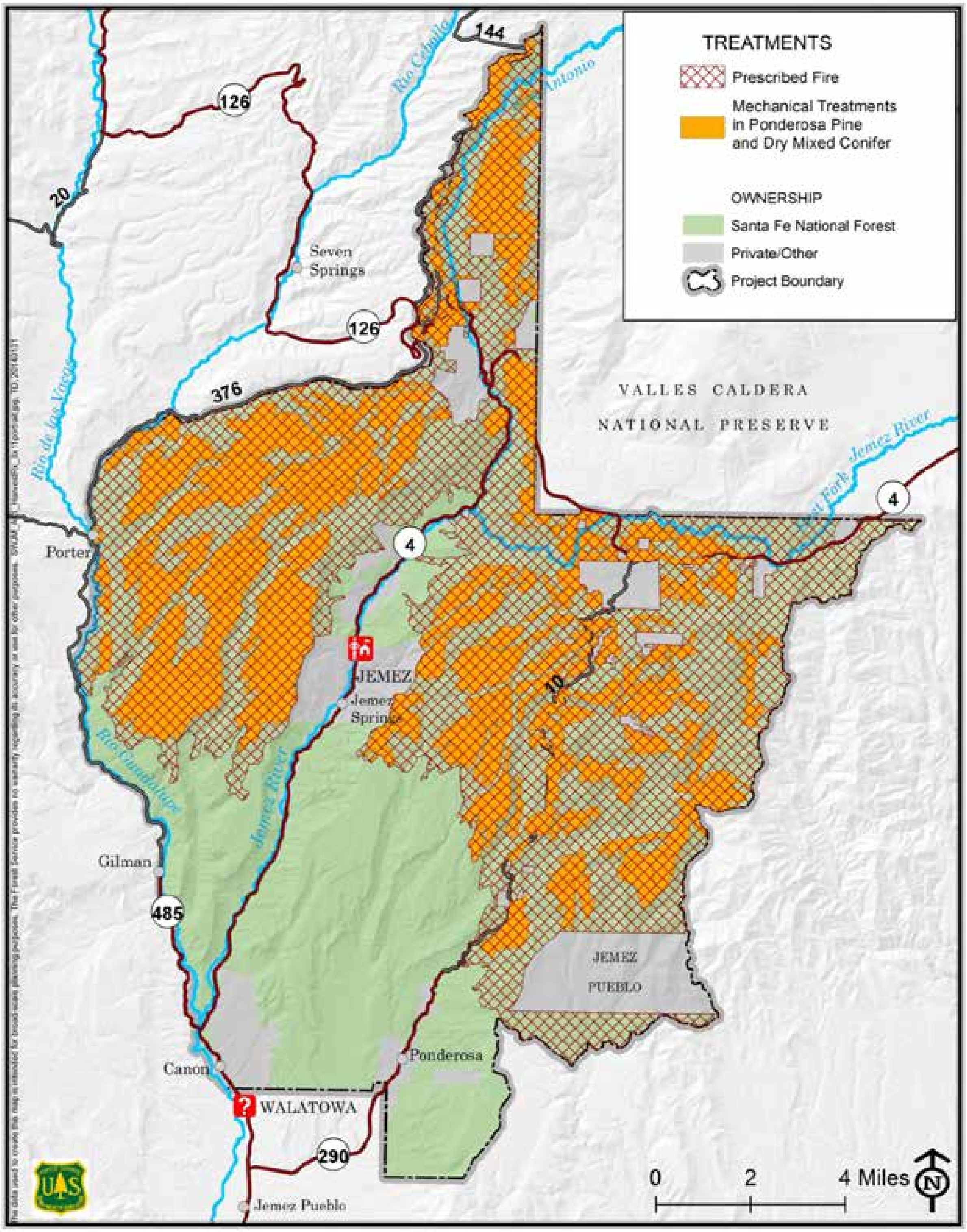

Figure 9. Potential locations of vegetation and prescribed fire treatments under Alternative 1 (proposed action). Under the proposed action, about 77,000 acres would be treated with prescribed fire and about 31,500 acres would receive mechanical or other treatments.

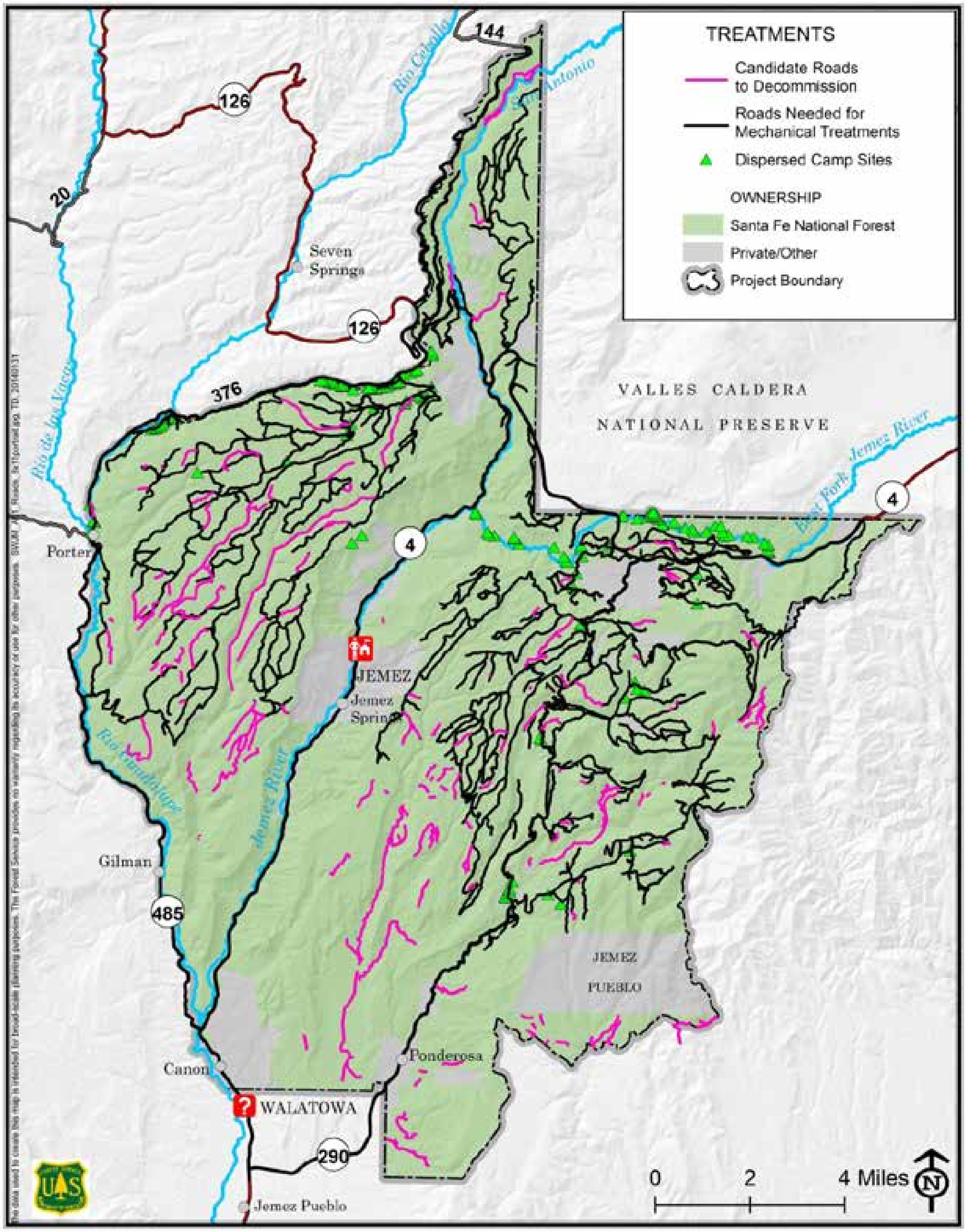

Figure 10. Potential locations of roads proposed for decommissioning and roads to be used for vegetation treatments in alternative 1. About 350 miles of forest roads would be used to access treatment areas and about 100 miles of road are proposed for decommissioning. Also shown are the approximately 150 dispersed campsites that would be rehabilitated.

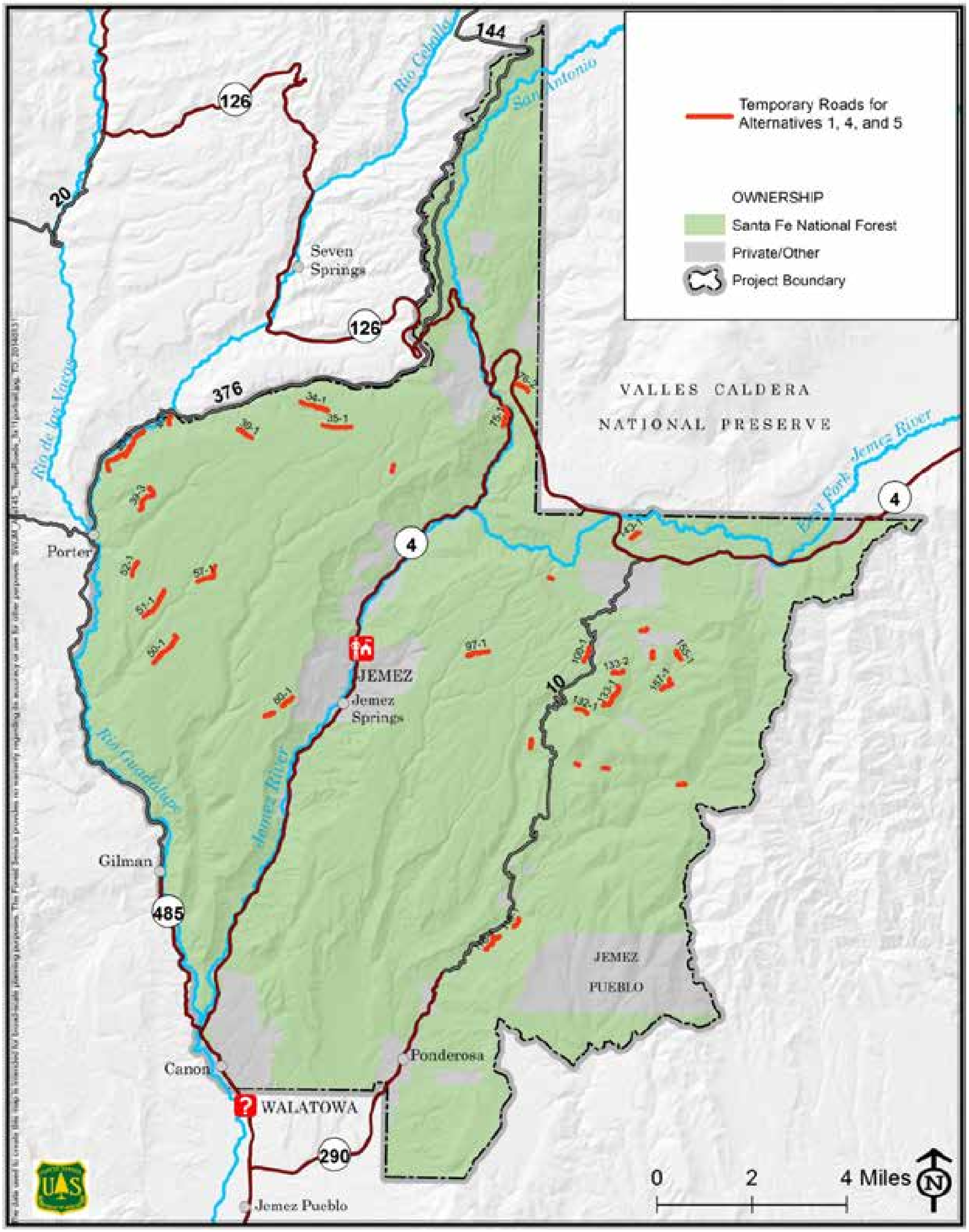

Figure 11 Location of proposed temporary roads under alternatives 1, 4, and 5. There are 12 miles of temporary roads. Most of the proposed temporary roads are located on the west side of the project area and east of Forest Road 10.

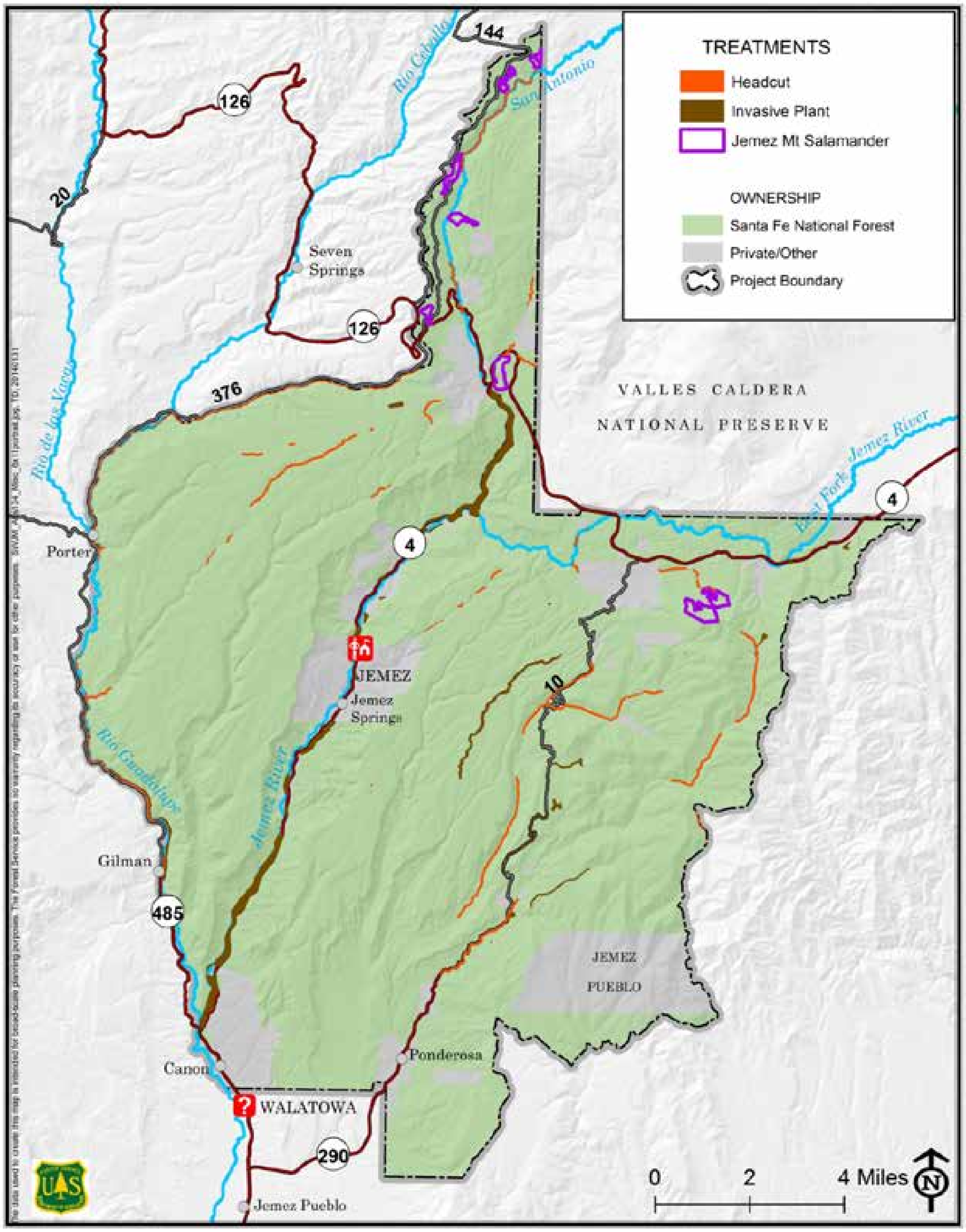

Figure 12. Potential locations of headcut and invasive plant control treatments and treatments in Jemez Mountains salamander habitat under all action alternatives (1, 3, 4, and 5). These treatments would not occur under alternative 2 (no action).

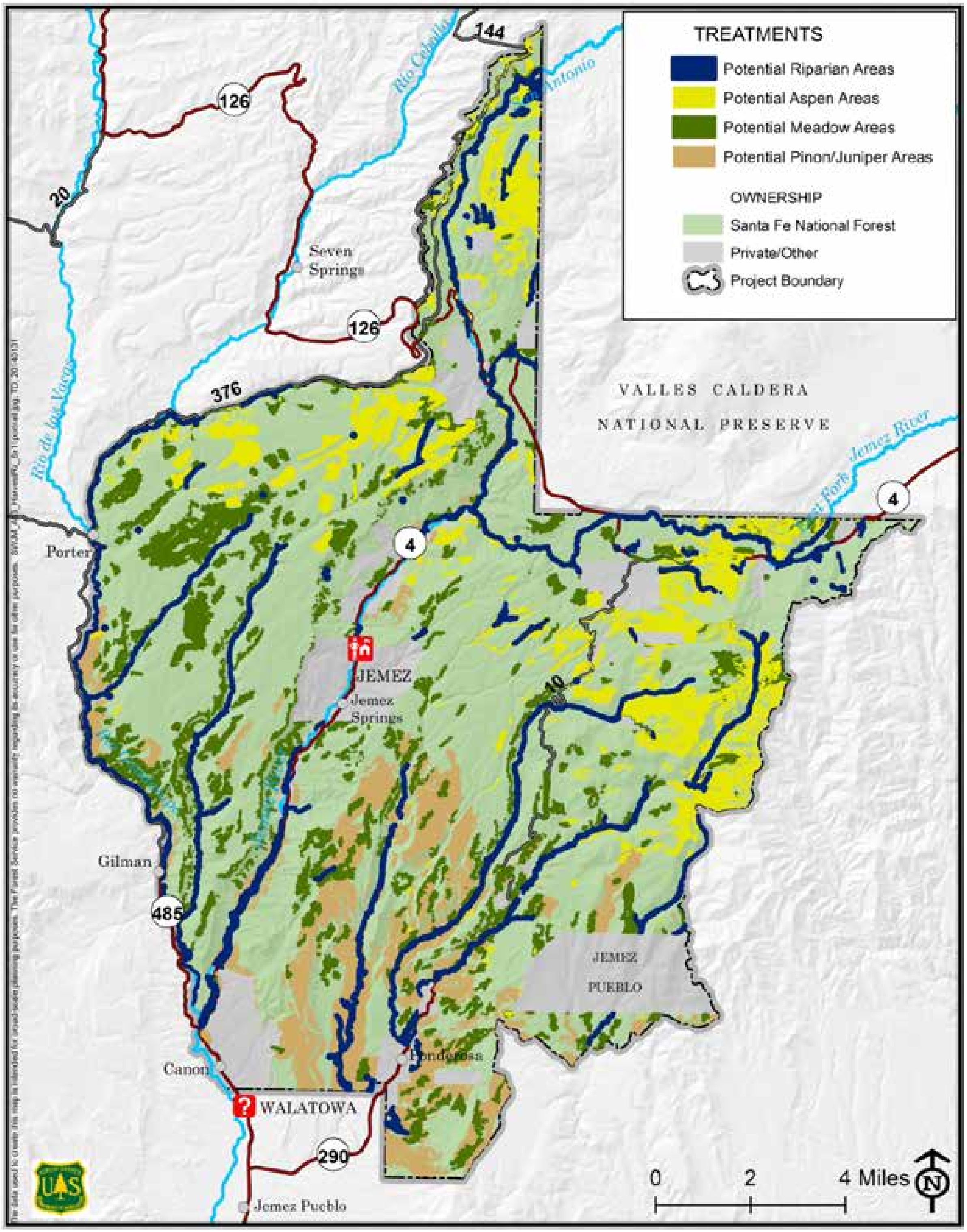

Figure 13. Potential locations of proposed meadow, riparian, aspen, and piñon-juniper treatments under all action alternatives (1, 3, 4, and 5). About 1,800 acres of aspen and 1,000 acres of piñon-juniper would be treated. None of these treatments would occur under alternative 2 (no action).

Alternative 2 – No Action

Alternative 2 is the no-action alternative as required by 40 CFR 1502.14(c). The no-action alternative provides a baseline condition for estimating the effects of the other alternatives. In this alternative there would be no changes in current management under the forest plan. Under current management there are a number of restoration projects approved through other environmental analysis and decisions that would occur within the proposed project area. They include approximately 1,000 acres of planned vegetation treatments, 18,400 acres of planned prescribed fire projects, 180 acres of wildlife treatments, and several recreation and other projects. Ongoing activities such as fire suppression, road maintenance, recreational activities, firewood gathering, grazing, and range improvement projects would continue. Preapproved activities such as nonnative and invasive plant control and travel management would also be accomplished. No site-specific forest plan amendments are needed to implement these activities.

There are a number of other activities that will occur in the project area but are not included in the no-action alternative because they are not restoration activities.

Figure 9 and Figure 10 show the proposed locations of the treatments described above.

Alternative 3 – No Construction of Temporary Roads

This alternative is intended to show effects of not constructing new temporary roads. Only those areas accessed by existing roads would be mechanically treated. Those acres not mechanically treated would be treated with prescribed fire only.

This alternative would reduce the area mechanically treated by approximately 1,900 acres as compared to alternative 1. All other treatments remain the same including prescribed fire in ponderosa pine and dry mixed conifer, invasive plant control, aquatic, riparian, and wildlife habitat improvement, cultural resource protection, road closure and decommissioning, construction of temporary roads, construction of gravel pits, and road maintenance Site-specific forest plan amendments are needed to implement this alternative (see tables 1 and 2).

Figure 14 and figure 15 show the proposed locations of the treatments described above. Figure 12 and figure 13 show the location of treatments common to all action alternatives (1, 3, 4, and 5) and are found at the end of the map section for alternative 1 (proposed action). These treatments include those for headcuts, invasive plants, meadows, riparian areas, aspen, and piñon-juniper forests.

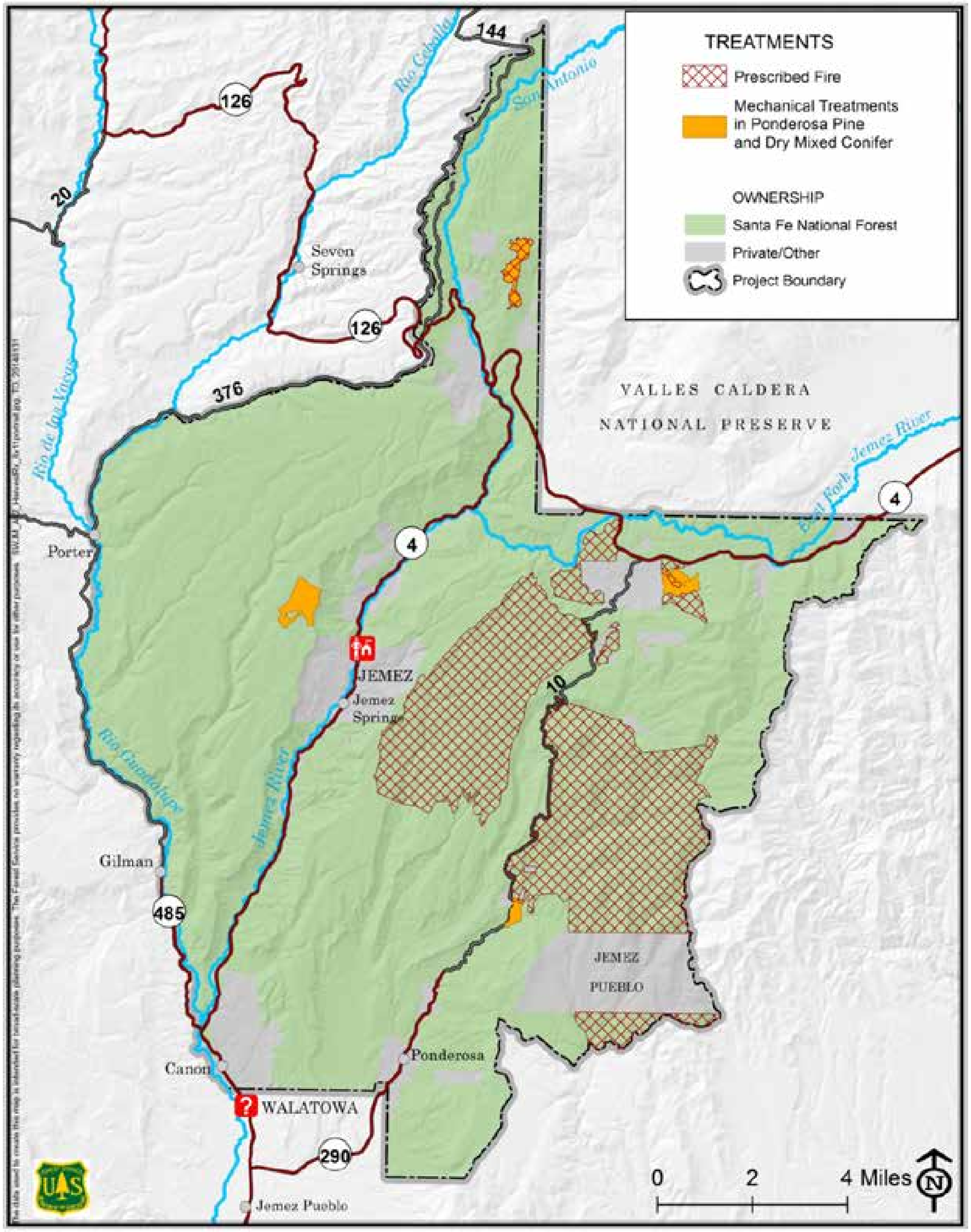

Figure 14. Potential treatment locations for mechanical treatments and prescribed fire under alternative 2 (no action). Approximately 1,000 acres would be mechanically treated and about 18,400 acres would be treated with prescribed fire

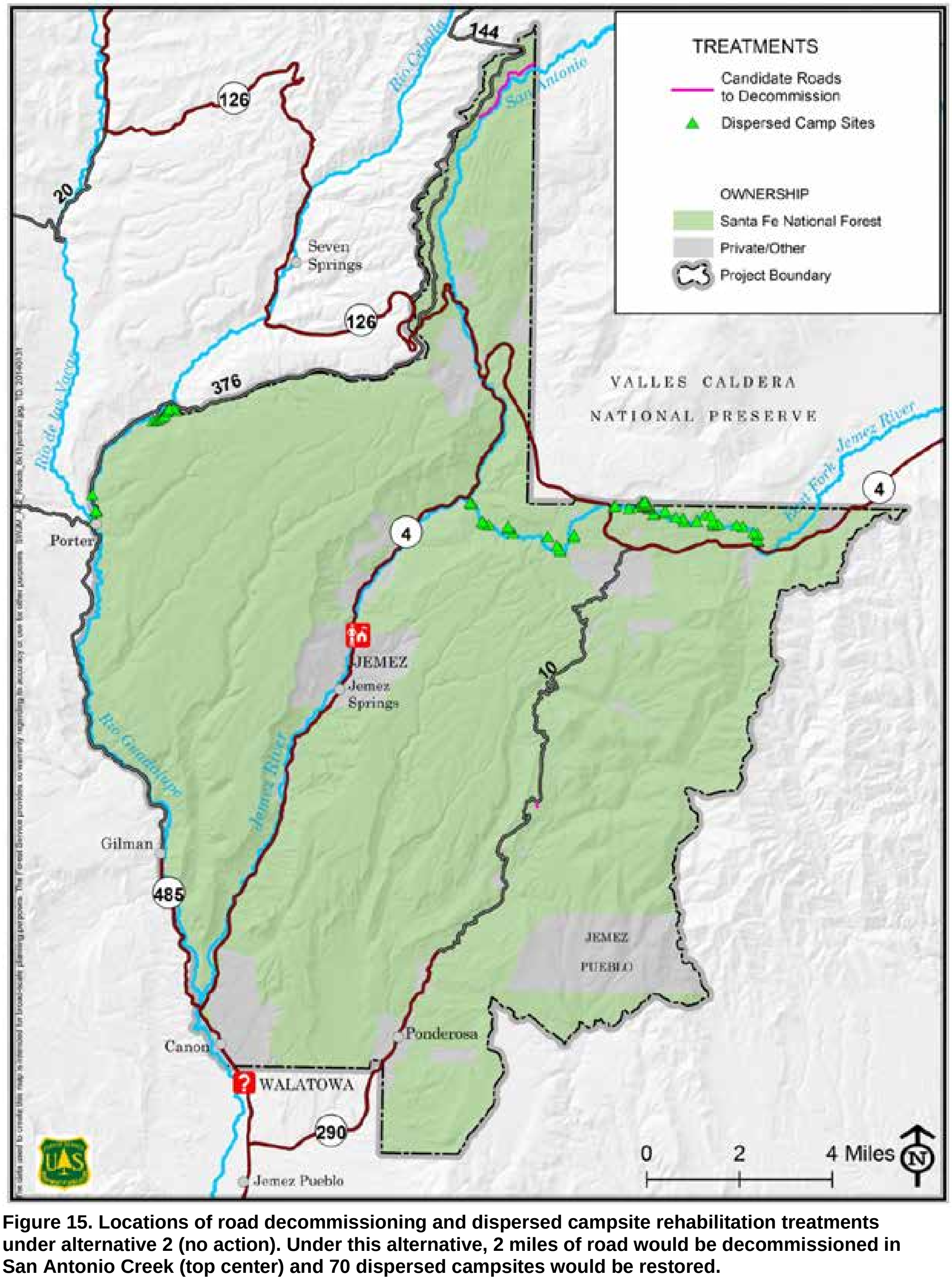

Figure 15. Locations of road decommissioning and dispersed campsite rehabilitation treatments under alternative 2 (no action). Under this alternative, 2 miles of road would be decommissioned in San Antonio Creek (top center) and 70 dispersed campsites would be restored.

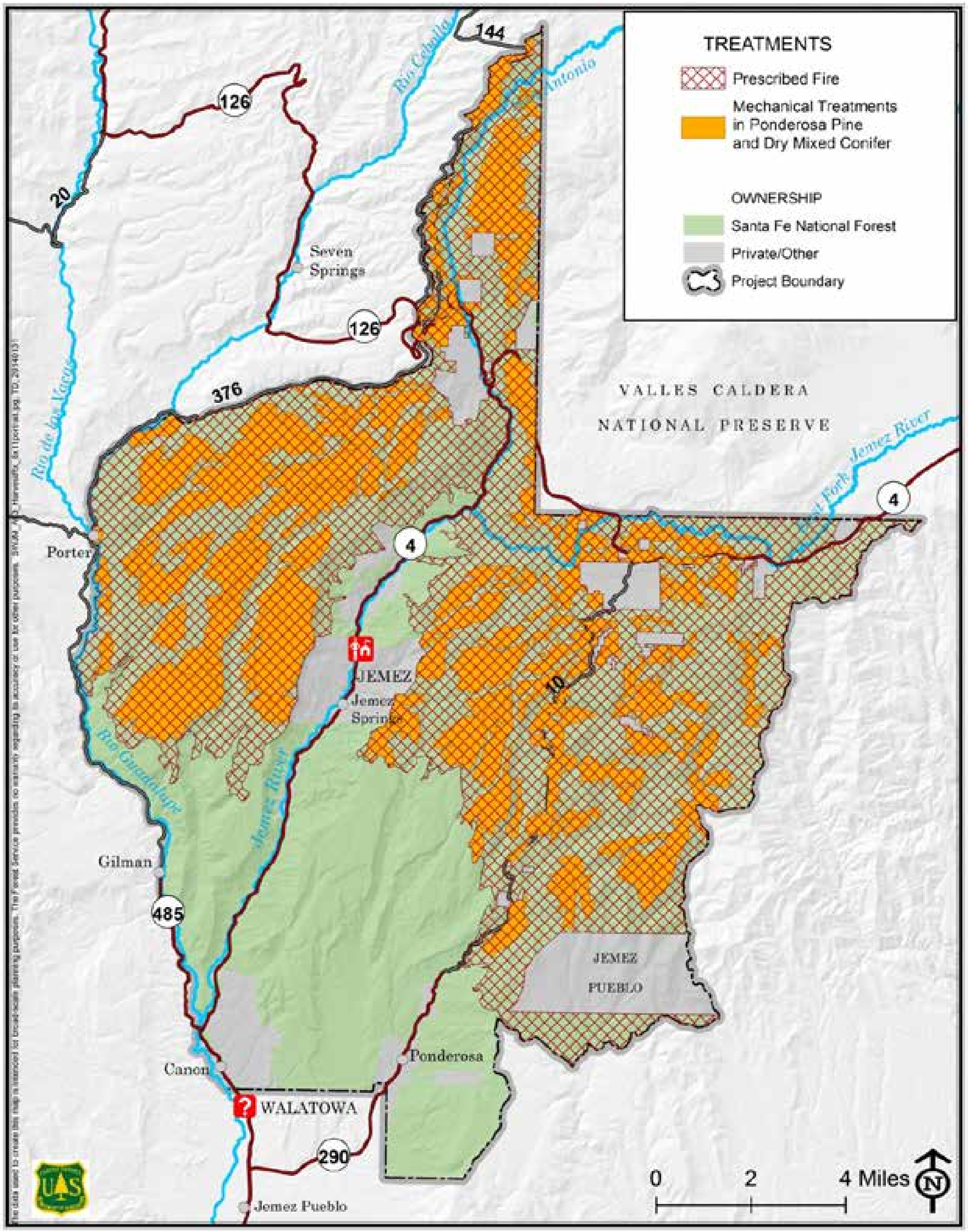

Figure 16. Potential locations of vegetation and prescribed fire treatments under alternative 3. Under this alternative, approximately 77,000 acres would be treated with prescribed fire; this is the same as the proposed action. About 30,000 acres would receive mechanical treatments; this is 1,900 acres less than the proposed action.

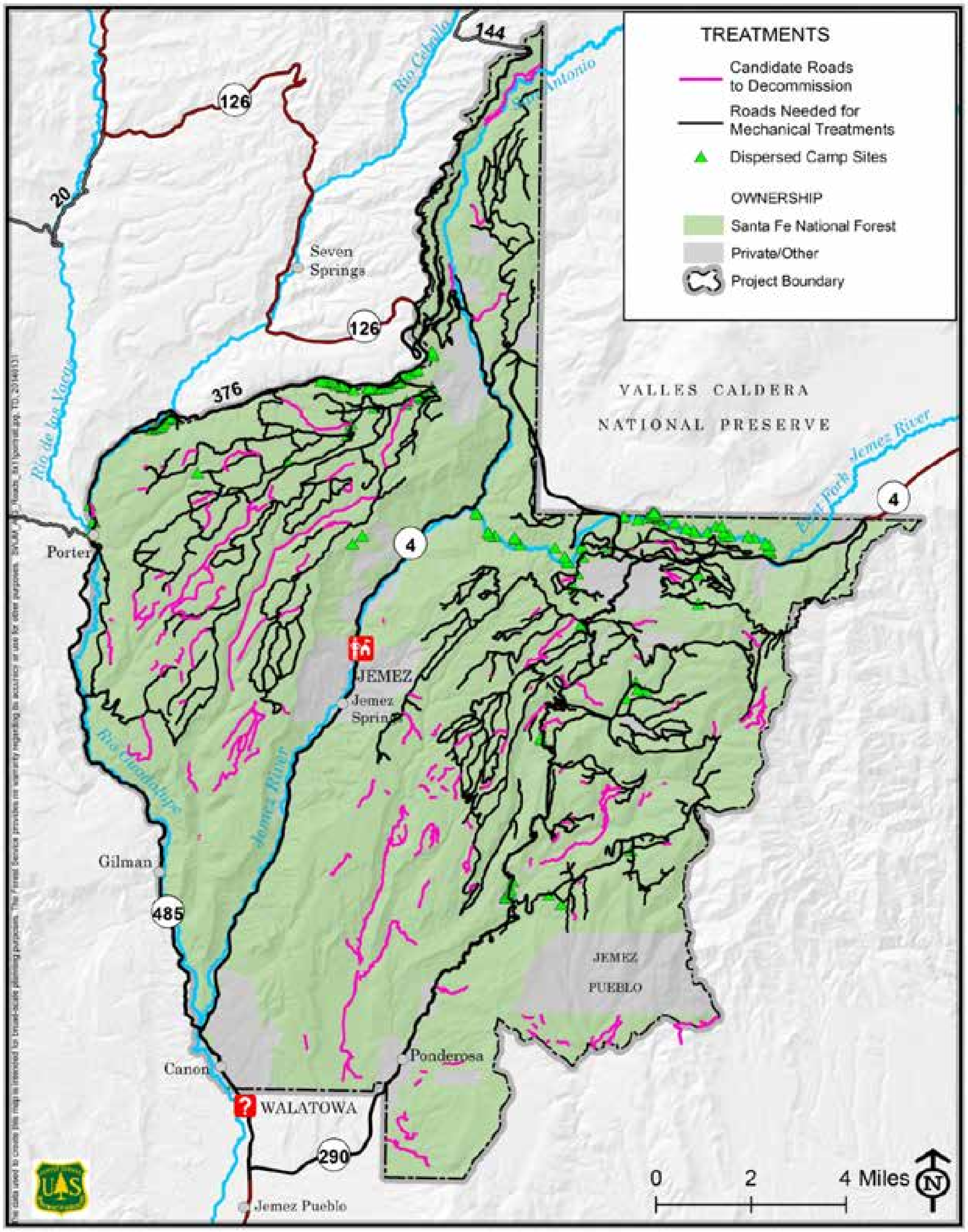

Figure 17. Potential locations of roads proposed for decommissioning and roads to be used for treatments under alternative 3. About 340 miles of forest roads would be used to access treatment areas, slightly less than the proposed action. About 100 miles of road are proposed for decommissioning, and about 150 dispersed campsites would be restored; this is the same as the proposed action.

Alternative 4 – No Prescribed Fire in Mechanical Treatment Areas

This alternative responds to the issues of smoke and scale of prescribed fire treatments by not burning areas that are mechanically treated. The total area treated is the same as the alternative 1. Slash from the mechanical treatments would not be burned, but would be chipped or ground up (masticated), or in some areas left on site (lopped and scattered). Prescribed fire would be used in those areas described under the proposed action as prescribed fire only. This alternative would reduce the acres burned from 77,000 to 45,400. This is a reduction of 31,600 acres or 41 percent. All other treatments remain the same including mechanical treatments and prescribed fire in ponderosa pine and dry mixed conifer, invasive plant control, aquatic, riparian, and wildlife habitat improvement, cultural resource protection, road closure and decommissioning, construction of temporary roads, construction of gravel pits, and road maintenance. Site-specific forest plan amendments are needed to implement this alternative (see tables 1 and 2).

Figure 18 and figure 19 show the proposed locations of the treatments described above. Figure 12 and figure 13 show the location of treatments common to all action alternatives (1, 3, 4, and 5) and are found at the end of the map section for alternative 1 (proposed action). These treatments include those for headcuts, nonnative and invasive plants, meadows, riparian areas, aspen, and piñon-juniper forests.

Alternative 5 – Implement the Existing Forest Plan Standards and Guidelines for Managing Mexican Spotted Owl Habitat (Amendment 6, 1996)

This alternative was designed in response to issues raised regarding treatments in Mexican spotted owl protected activity centers and restricted habitat. This alternative reduces with prescribed burning area treated by approximately 700 acres. This alternative would comply with the current forest plan. The proposed forest plan amendments related to treatments in Mexican spotted owl habitat would not be needed to implement this alternative. The remaining proposed site-specific forest plan amendments would be needed to implement this alternative.

All other treatments remain the same including mechanical treatments and prescribed fire in ponderosa pine and dry mixed conifer, invasive plant control, aquatic, riparian, and wildlife habitat improvement, cultural resource protection, road closure and decommissioning, construction of temporary roads, construction of gravel pits, and road maintenance. Site-specific forest plan amendments are needed to implement this alternative (see table 2).

Figure 20 and figure 21 show the proposed locations of the treatments described above. Figure 12 and figure 13 show the location of treatments common to all action alternatives (1, 3, 4, and 5) and are found at the end of the map section for alternative 1 (proposed action). These treatments include those for headcuts, nonnative and invasive plants, meadows, riparian areas, aspen, and piñon-juniper forests.

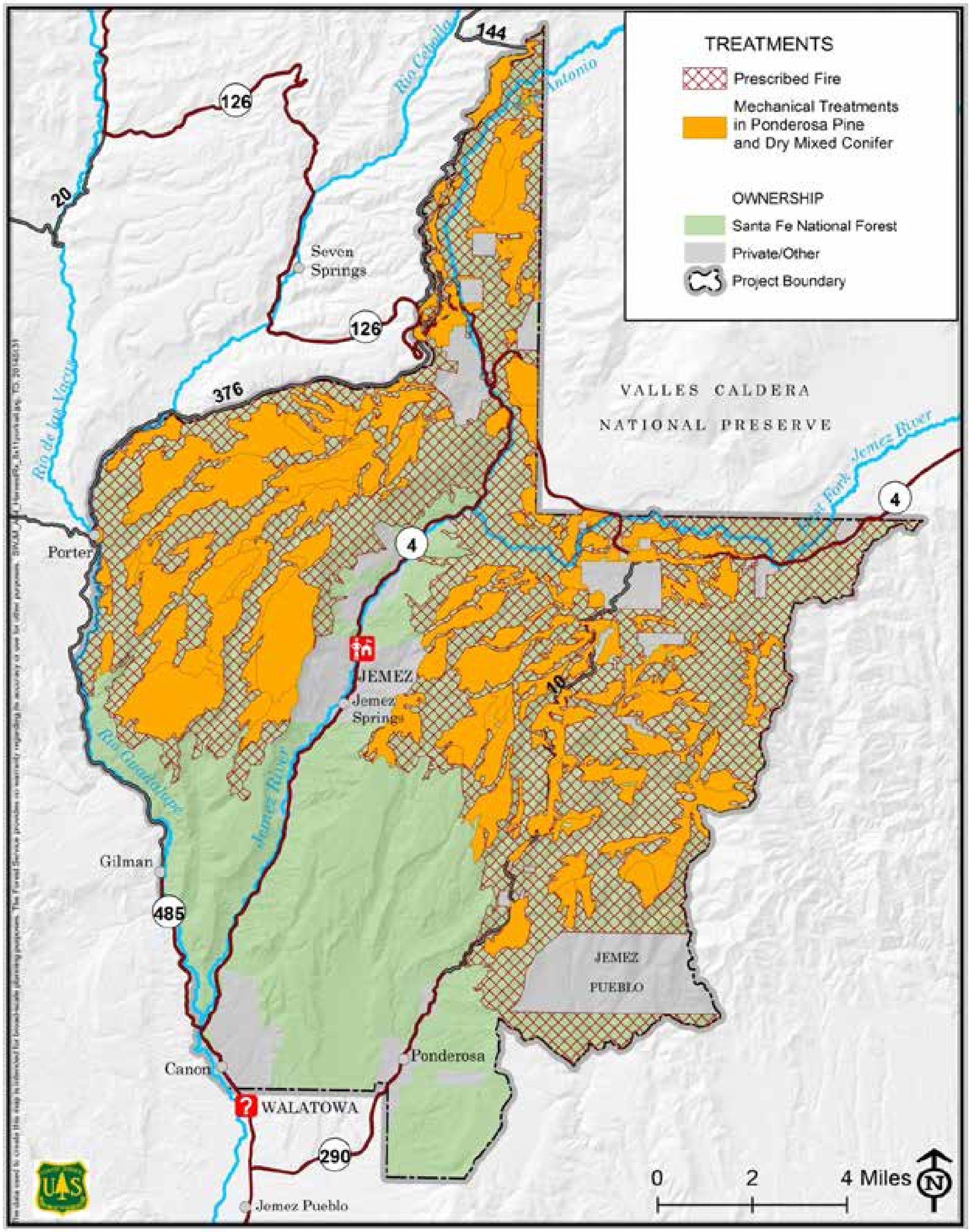

Figure 18. Potential locations of vegetation and prescribed fire treatments under alternative 4 in ponderosa pine, dry mixed conifer, and wet mixed conifer forest types. Under this alternative, mechanical treatments would occur on 31,500 acres, the same as the proposed action. Approximately 45,400 acres would be treated with prescribed fire, about 31,600 acres less than the proposed action.

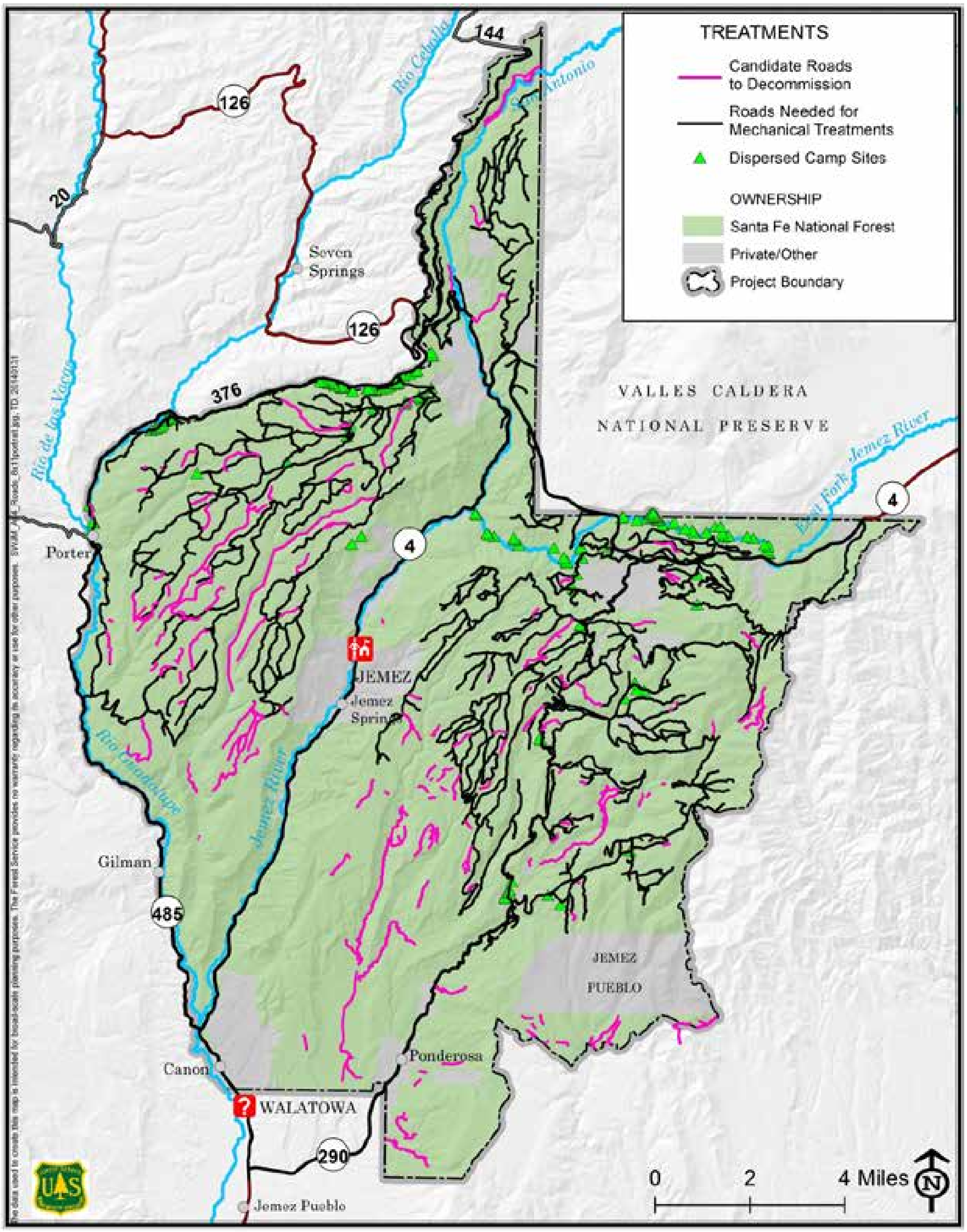

Figure 19. Locations of roads proposed for decommissioning and roads to be used for vegetation treatments under alternative 4. About 350 miles of existing forest roads would be used to access treatment areas. About 100 miles of road are proposed for decommissioning, and about 150 dispersed campsites would be rehabilitated.

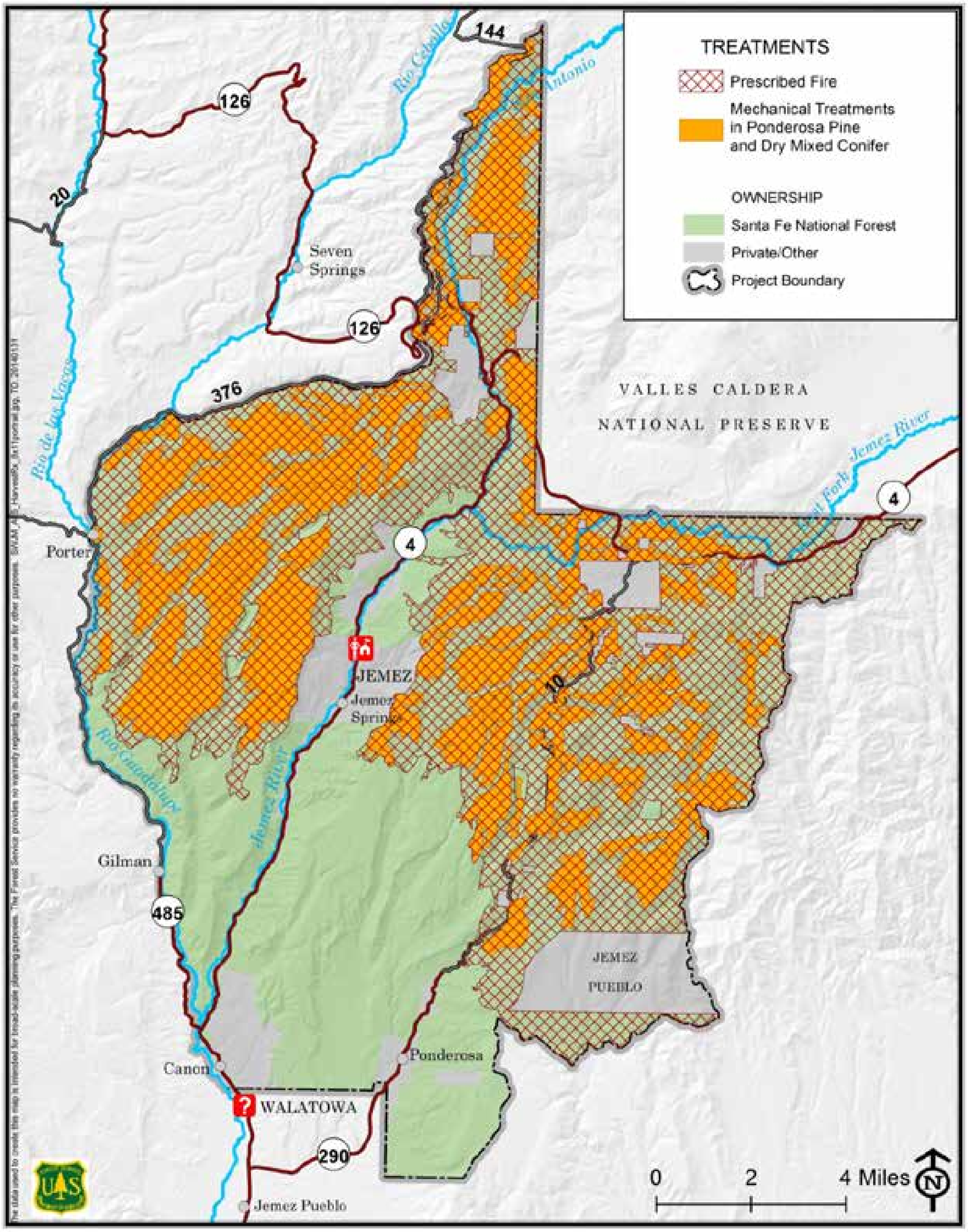

Figure 20. Potential locations of vegetation and prescribed fire treatments under alternative 5. Mechanical treatments would occur on 31,500 acres, the same as the proposed action. Approximately 76,300 acres would be treated with prescribed fire, about 700 acres less than the proposed action.

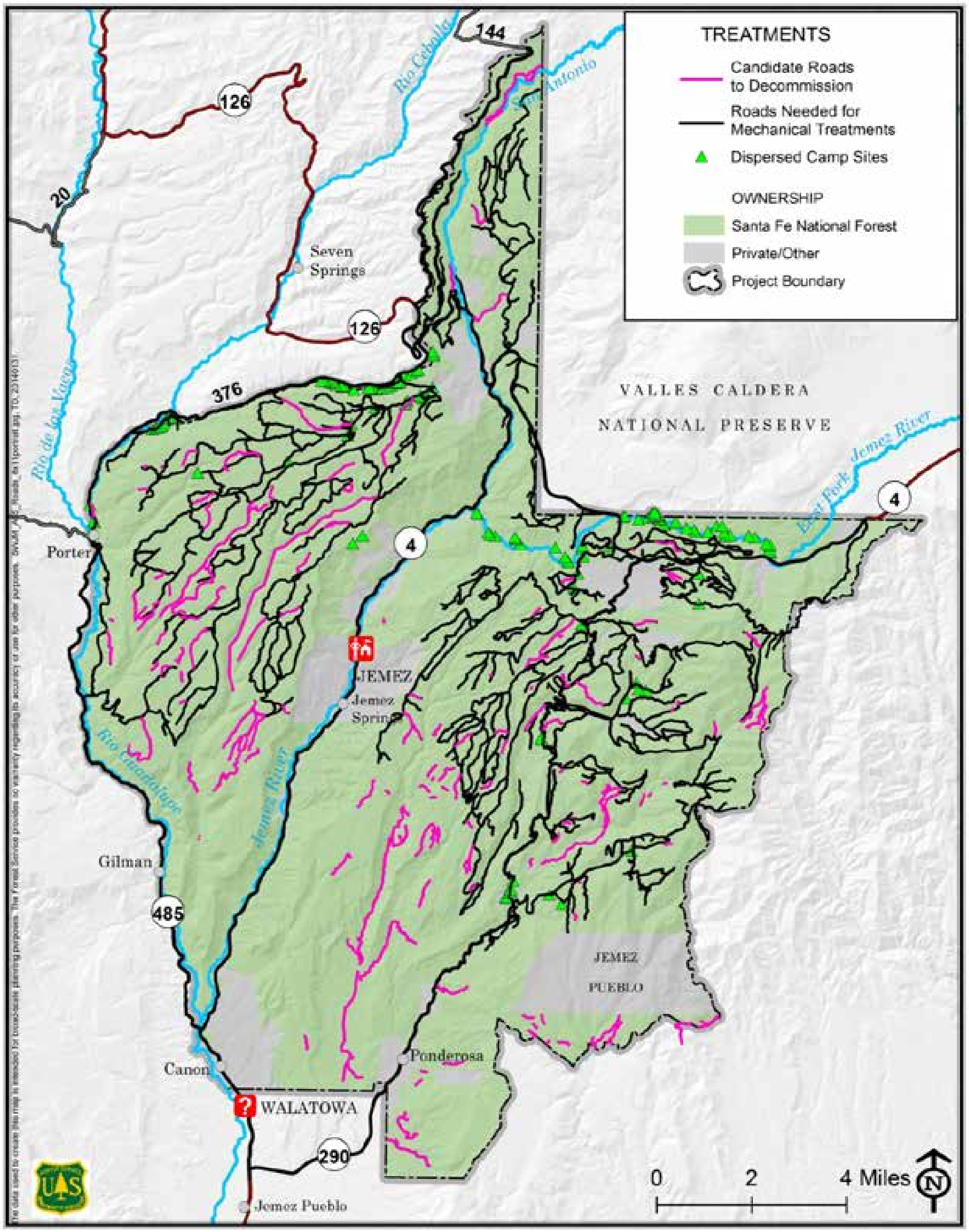

Figure 21. Location of roads proposed for decommissioning and roads to be used for vegetation treatments under alternative 5. About 350 miles of existing forest roads would be used to access treatment areas. About 100 miles of road are proposed for decommissioning, and about 150 dispersed campsites would be rehabilitated.

Mitigation Measures for All Action Alternatives

To reduce impacts we would use all relevant resource protection measures. These measures are generated from environmental regulations, Forest Service directives, applicable forest plan standards and guidelines, and best management practices. In addition, project-specific design features and mitigation measures were developed to minimize adverse effects that were identified during the analysis. Project-specific protective measures are listed in appendix A and would be used with all action alternatives.

Monitoring

Chapter 5 of the forest plan includes the monitoring and evaluation activities to be conducted as part of forest plan implementation. For all action alternatives, we would conduct the implementation monitoring as required in chapter 5 of the forest plan.

Forest Plan Amendments

Forest plan amendments (tables 1 and 2) are needed to achieve the purpose and need and to assure consistency with the forest plan. These are site-specific amendments and would apply to this project only. The forest plan would be amended using the 1982 rule procedures as allowed by the transition language of the 2012 planning rule ((36 CFR 219.17(b)(3)).

Required Permits, Approvals, and Consultation

- The discharge of dredged and fill material resulting from the instream habitat improvement treatments requires a section 404 permit from the U.S. Army Corps of Engineers.
- The discharge of pollutants (sediment) to waters of the U.S. requires a Clean Water Act 401 Water Quality Certification and a Clean Water Act 402 National Pollutant Discharge Elimination System (NPDES) permit from the New Mexico Environment Department.
- Consult with and obtain concurrence from the U.S. Fish and Wildlife Service on which listed species to address in the biological assessment, and continue consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act.
- Consult with the New Mexico State Historic Preservation Officer, tribes, and consulting parties regarding identification, evaluation, and determination of effects of the project on cultural resources in accordance with Section 106 of the National Historic Preservation Act.
- Coordinate prescribed fire applications with appropriate air quality specialists and Federal and State, regulatory authorities to ensure compliance with their regulations.
- Tree cutting in inventoried roadless areas: This is allowed under applicable regulations, but under current policy implementing treatments outlined in all the action alternatives would require Regional Forester approval to cut trees in the inventoried roadless areas.

Table 1. Amendments for alternatives 1, 3, and 4

Existing Forest Plan Language	Purpose of the Amendment (Reason for Change)	Proposed Forest Plan Language
In Mexican Spotted Owl Protected Activity Centers: Designate a 100-acre “no treatment” area around the known nest site of each selected protected activity center. (Appendix D – Standards and Guidelines for Management of Mexican Spotted Owl, Northern Goshawk, and Livestock Grazing).	The 2012 Mexican Spotted Owl Recovery Plan allows prescribed fire in the 100-acre no treatment area.	Designate a 100-acre limited treatment area around the identified core area of a protected activity center (PAC). Limited treatment means that only prescribed fire is allowed.
In Mexican Spotted Owl Protected Activity Centers: Select for treatment 10% of the protected activity centers where nest sites are known in each recovery unit having high fire risk conditions. (Appendix D – Standards and Guidelines for Management of Mexican Spotted Owl, Northern Goshawk, and Livestock Grazing).	This guidance is in line with the 2012 Mexican Spotted Owl Recovery Plan and allows us to treat all six PACs within the project area and better achieve desired conditions.	Conduct restoration treatments in up to 20% of PACs within each ecosystem management unit (EMU) that exhibits high fire risk conditions.
In Mexican Spotted Owl Protected Activity Centers: Also select another 10% of the protected activity centers where nest sites are known as a paired sample to serve as control areas. (Appendix D – Standards and Guidelines for Management of Mexican Spotted Owl, Northern Goshawk, and Livestock Grazing).	The proposed monitoring was developed in conjunction with USFWS and allows for us to monitor changes but still treat the PACs.	Paired monitoring of PACs will take place within the project area using the existing PACs and separating treatments within PACs by at least two years. This will aid in distinguishing between effects from treatment versus environmental or other influences on Mexican spotted owl.
In Mexican Spotted Owl Protected Activity Centers: Use combinations of thinning trees less than 9 inches in diameter, mechanical fuel treatment and prescribed fire to abate fire risk in the remainder of the selected protected activity center outside the 100-acre “no treatment” area. (Appendix D – Standards and Guidelines for Management of Mexican Spotted Owl, Northern Goshawk, and Livestock Grazing)	To meet the desired conditions, we want to be able to cut trees up to 18-inches diameter in PACs, outside of the core area.	Within Mexican spotted owl PACs, use combination of cutting trees less than 18-inches diameter, mechanical fuel removal, and prescribed fire to treat fuel accumulations to abate fire risk.

Existing Forest Plan Language	Purpose of the Amendment (Reason for Change)	Proposed Forest Plan Language
In Mexican Spotted Owl Restricted Areas: The following table displays the minimum percentage of restricted area which should be managed to have nest/roost characteristics. The minimum mixed conifer restricted area includes 10% at 170 basal area and an additional amount of area at 150 basal area. The additional area of 150 basal area is +10% in BR-E and +15% in all other recovery units. The variables are for stand averages and are minimum threshold values and must be met simultaneously. In project design, no stands simultaneously meeting or exceeding the minimum threshold values should be reduced below the threshold values unless a district-wide or larger landscape analysis of restricted areas shows that there is a surplus of restricted area acres simultaneously meeting the threshold values. Management should be designed to create minimum threshold conditions on project areas where there is a deficit of stands simultaneously meeting minimum threshold conditions unless the districtwide or larger landscape analysis shows there is a surplus. (see table 1a below)	Adjusts requirements for nest/roost characteristics in recovery habitat to guidance from the 2012 Mexican Spotted Owl Recovery Plan.	Table C.3 from the revised recovery plan (p. 278) displays the minimum desired conditions for mixed-conifer forest areas managed for recovery nesting/roosting habitat. Manage stands so that a specified portion (25%) of the landscape does not fall below the lower stand condition thresholds in table C.3. Identify and protect stands that meet or exceed nest/roost conditions and then assess whether or not these stands satisfy this area requirement. Stands that do not meet nest/roost conditions and are not designated for development of such can be managed to meet other resource objectives. The environmental analysis for this project is striving for these desired conditions in the recommended amounts at this large spatial scale. see table 1b below)
In Mexican Spotted Owl Restricted Areas: Encourage prescribed and prescribed natural fire to reduce hazardous fuel accumulation. Thinning from below may be desirable or necessary before using prescribed fire to reduce ladder fuels and the risk of crown fire. (Appendix D – Standards and Guidelines for Management of Mexican Spotted Owl, Northern Goshawk, and Livestock Grazing)	Remove language specifying the use of thinning from below. This can indicate that only the lowest size classes of trees are removed. Uneven-aged management requires the removal of intermediate size classes as well.	Encourage prescribed and prescribed natural fire to reduce hazardous fuel accumulation. Thinning may be desirable or necessary before using prescribed fire to reduce ladder fuels and the risk of crown fire.

Table 1a. Existing Forest Plan, Appendix D – Standards and Guidelines for Management of Mexican Spotted Owl, Northern Goshawk, and Livestock Grazing

Variable	MC ALL RU	MC BR-E RU	MC OTHER RU	Pine-oak
Restricted area %	10%	+10%	+15%	10%
Stand Averages for: Basal	170	150	150	150

Variable	MC ALL RU	MC BR-E RU	MC OTHER RU	Pine-oak
Area				
18 inch + trees/ac	20	20	20	20
Oak basal area	NA	NA	NA	20
Percent total existing stand density index by size class:				
12-18"	10	10	10	15
18-24"	10	10	10	15
24+"	10	10	10	15

Table 1b. Minimum desired conditions for Mexican Spotted Owl Recovery nesting/roosting habitat in the mixed-conifer forest type of the Southern Rocky Mountain Ecological Management Unit[1].

Percent of Area[2]	25%
Percent Basal Area in 12-18 inch d.b.h. class	>30
Percent Basal Area in > 18-inch d.b.h. class	>30
Minimum Tree Basal Area[3]	27.5 (120)
Minimum Density of Large Trees[4]	30 (12)

[1] This table is derived from table C.3 in the revised recovery plan for the Mexican spotted owl (USFWS 2012). Notes 2, 3, and 4 are the original table notes from table C.3.

[2] Percent of area pertains to the percent of the planning area, subregion, and/or region in the specified forest type that should be managed for threshold conditions.

[3] BAs in m^2/ha (ft^2/acre), and include all trees >1 inch d.b.h. (i.e., any species). We emphasize that values shown are **minimums**, not targets.

[4] Trees > 46 cm (18 inches) d.b.h. Density is tree/ha (trees/acre). Again, values shown are minimums rather than targets. We encourage retention of large trees.

Table 2. Amendments for alternatives 1, 3, 4, and 5

Existing Forest Plan Language	Purpose of the Amendment (Reason for Change)	Proposed Forest Plan Language
Northern goshawk: Limit human activities in nesting areas during the breeding season. (March 1- September 30). Limit human activity in or near nest sites and post-fledgling family areas during the breeding season so that goshawk reproductive success is not affected by human activities. (Appendix D – Standards and Guidelines for Management of Mexican Spotted Owl, Northern Goshawk, and Livestock Grazing)	Allows treatment during breeding season which facilitates meeting desired conditions.	Northern goshawk: Human activities will be limited to no more than two consecutive years during the breeding season (March 1 to September 30).
No corresponding forest plan direction regarding interspaces. (Appendix D – Standards and Guidelines for Management of Mexican Spotted Owl, Northern Goshawk, and Livestock Grazing and Glossary (for the definition) pp. 195-224). The definition will be added to the Glossary – pp. 195-224.	Adds language to allow for interspaces in addition to VSS groups 1-6.	Canopy cover is evaluated at the group level within mid-aged to old forest structural stages groups (VSS 4, VSS 5, and VSS 6) and not within grass/forb/shrub to young forest structural stage groups (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows, and grasslands, or other areas not managed for forest conditions. (Definition) Interspaces are areas not currently under the vertical projection of the outermost perimeter of tree canopies. They are generally composed of grass-forb-shrub communities but could also be areas with scattered rock or exposed mineral soil. Interspaces do not include meadows, grasslands, rock outcroppings, and wetlands (i.e., exclusions adjacent to and sometimes within forested landscapes.)
Timber activities in turkey nesting areas will be coordinated to minimize impacts between April 20 and June 10 (replacement page 72).	Allows treatment during breeding season which facilitates meeting desired conditions. The nesting areas are not defined. It is impractical to identify Turkey nesting areas. The benefits of the project outweigh the potential detriments to turkeys.	Delete.

Existing Forest Plan Language	Purpose of the Amendment (Reason for Change)	Proposed Forest Plan Language
When a peregrine falcon site plan doesn't already exist and a Biological Evaluation finds that a proposed action may negatively impact an occupied eyrie, develop a site plan for the eyrie before approving the project. Adhere to site plan mitigations for the eyrie. (Replacement page 62) Develop a site plan for each peregrine falcon eyrie (designated suitable nest site). Follow the specific requirements described in the site plans for each eyrie and the surrounding habitat zones, including requirements for evaluating potential impacts, monitoring, restricting the timing of activities, and controlling activities that may cause disturbance or pose a threat to the eyrie (replacement page 63).	Site plans established zones with time restrictions for up to 4 miles outward of the eryie to avoid disturbance to peregrine falcon. Adhering to such restrictions would significantly delay restoration work and inhibit the Forest's ability to meet the intent of the CFLRP.	The Forest will do project level surveys within 1/2 mile of peregrine falcon nesting habitat ("A" zone) before and after project activities to assess how these activities affect occupancy and nest use.
Develop viewshed corridor plans for those sensitive level 1 roads specified in each management area. These plans will define project level landscape characteristics and identify the key visual elements for management. Plans will outline the activities to sustain the desired scenic landscape character overtime. (Replacement page 56)	The forest does not currently have any of these plans in place. The intent of these viewshed corridor plans will be met through design criteria and mitigations included in the project.	Delete.
Manage for a visual quality objective of preservation (p. 151)	The visual quality objective of preservation conflicts with the amendment in the Jemez National Recreation Area that allows for vegetation treatments in this management area ('M').	Manage for a Visual Quality Objective of High.

Alternatives Considered but Eliminated from Detailed Study

The National Environmental Policy Act requires Federal agencies to consider a range of reasonable alternatives. For alternatives that were not considered in detail, agencies must briefly discuss the reasons for eliminating them (40 CFR 1502.14). The range of alternatives considered by the responsible official includes alternatives to the proposed action that are analyzed in the document, as well as other alternatives considered but eliminated from detailed study. The following alternatives were developed in response to issues raised in scoping, but were eliminated for reasons explained below.

Use a 16-inch Diameter Cap on All Treatments

This alternative responds to the issue of retaining large trees. The 16-inch diameter limit was selected because it was often cited as an upper limit for tree cutting in the scoping comments. This alternative would apply to all of the vegetation treatments and design criteria outlined in the proposed action. All other treatments involving tree cutting would include the cap.

We eliminated this alternative from detailed analysis because it fails to meet the purpose and need of the project. We developed the proposed action to achieve several ecosystem restoration objectives, not only to reduce wildfire hazard. Cutting larger trees would reduce hazardous fuels, but more importantly, removing larger trees in certain situations would improve ecological conditions.

The proposed forest restoration treatments focus on removing small trees first. We have enough site-specific knowledge of the project area to determine that an arbitrary diameter cap would not meet our restoration objectives in some circumstances: (1) for grassland, meadow, and riparian area restoration; (2) where stands are dominated by young, large trees; (3) in stands where large, late transitional (seral), fire-sensitive species (such as white fir) are undesirable; (4) in aspen or group regeneration areas; (5) in interspaces, (6) where severe, forest disease, insects or damage is present; and (7) where necessary to manage forest age distribution towards uneven-aged conditions.

Cutting larger trees for restoration purposes is supported by science (Fiedler and Keegan 2003; Abella et al. 2006; Lee and Irwin 2005; Prather et al. 2008). A study by Triepke et al. (2011) modeled and analyzed the effects of a 16-inch diameter cap on forest structure, forest composition, and fire behavior on dry forests on National Forest System lands in New Mexico and Arizona. Their analysis showed that within 30 years, nearly all stands managed using a diameter cap would be converted to an even-aged condition. Such a landscape lacks biodiversity and indicates that the system is unstable and is susceptible to large-scale disturbances such as wildfire.

Fiedler and Keegan (2003) had similar results. Their study compared a range of treatments in dry forest in New Mexico: (1) thinning from below; (2) a 16-inch diameter cap; and (3) a restoration treatment that removed trees of all sizes. They concluded that “The restoration prescription evaluated in this analysis achieves greater hazard reduction and creates more sustainable conditions than alternative treatments. It is particularly superior when compared to prescriptions with a singular focus on removal of small trees,” (p. 46).

Reduce the Area Treated with Prescribed Fire by Using Skyline Harvesting on Steep Slopes (greater than 40 percent)

This alternative responds to the issues of smoke and scale of the prescribed fire treatments. In this alternative, skyline harvesting would occur on steep slopes instead of burning these areas. All other treatments would remain the same including the mechanical treatments on flatter ground, cutting trees for meadow restoration, seeps and springs, cultural site protection, and other restoration treatments.

We eliminated this alternative from detailed analysis because while it is technically feasible, it is not likely to be economically feasible. It would require extensive analysis regarding harvesting systems and many miles of additional temporary roads to support this harvesting system. To reduce fuels on the slopes, whole tree yarding would be needed and would not result in a measurable difference in the total amount of smoke produced as the slash from the skyline units would be burned at the landings.

Reduce Mechanical Treatments in Jemez Mountains Salamander Habitat

This alternative was designed in response to an internal discussion about protecting the Jemez Mountains salamander and its habitat. Under this alternative, we would reduce treatments in the two areas mapped as Jemez Mountains salamander critical habitat. These areas total approximately 9,000 acres (27 percent of the total area that would be mechanically treated). Treatments outside these two large areas would be carried out as described in the proposed action.

Treatments within the Jemez Mountains salamander areas would be modified to use the upper limits of the canopy closure described in the proposed action or the treatments would be dropped. Additional mitigation measures such as no use of wheeled or tracked equipment and use of winter harvesting, would be applied to reduce salamander mortality.

We eliminated this alternative as originally developed because we added design criteria to all of the action alternatives to address the primary threat to the salamander (uncharacteristically severe wildfire) and to provide protection of known populations.

Comparison of Effects of the Different Alternatives

Table 3 summarizes and compares the key measures related to the purpose and need and environmental effects of each of the alternatives considered in detail. Chapter 3 has a detailed discussion of the measures and description of effects.

Table 3. Comparison of the environmental effects of each of the alternatives

Objective or Issue	Key Measure	Alternative 1 Proposed Action	Alternative 2 No Action	Alternative 3 No Temporary Roads	Alternative 4 No Prescribed Fire in Mechanical Treatment Areas	Alternative 5 No Mexican Spotted Owl Amendments
Selective cutting and prescribed fire in ponderosa pine	Acres	23,000	550	21,450	23,000	23,000
Stand improvement thinning and prescribed fire in ponderosa pine	Acres	1,500	80	1,450	1,500	1,500
Selective cutting and prescribed fire in dry mixed conifer	Acres	5,300	250	5,050	5,300	5,300
Stand improvement thinning and prescribed fire in dry mixed conifer	Acres	80	0	80	80	80
Landscape prescribed fire	Acres	77,000	18,400	77,000	45,400	76,300
Treatments in wet mixed conifer	Acres	1,150	0	1,150	1,150	1,150
Treatments to maintain or increase aspen cover type	Acres	1,800	0	1,800	1,800	1,800
Treatments in piñon-juniper	Acres	1,000	0	1,000	1,000	1,000
Treatments for cultural site protection	Sites	2,934	622	2,934	2,933	2,918
Treatments to restore areas damaged by dispersed recreation and enhance native riparian vegetation	Sites	150	70	150	150	150
Restore instream habitat	Miles	24	7	24	24	24

Objective or Issue	Key Measure	Alternative 1 Proposed Action	Alternative 2 No Action	Alternative 3 No Temporary Roads	Alternative 4 No Prescribed Fire in Mechanical Treatment Areas	Alternative 5 No Mexican Spotted Owl Amendments
Treatments for maintaining or increasing meadow habitat	Acres	5,500	171	5,500	5,500	5,500
Treatments to enhance Mexican spotted owl habitat in protected activity centers	Acres	484	0	484	484	484
Acres allocated to old growth	Acres	14,050	0	14,050	14,050	14,050
Treatments to enhance seeps and springs	Acres	175	12	175	175	175
Treatments to reduce erosion effects from headcuts	Acres	860 (estimated)	0	860 (estimated)	860 (estimated)	860 (estimated)
Roads re-opened, maintained, and closed after use	Miles	107	0	96	107	107
Temporary roads	Miles	12	0	0	12	12
Open Roads Maintained	Miles	242	47	242	242	242
Road decommissioning	Miles	Up to 100	2	Up to 100	Up to 100	Up to 100
Air quality	Estimated total CO_2 emissions	2,633,000 tons	517,000 tons	2,594,000 tons	1,173,000 tons	2,598,000 tons
Air quality	Estimated total $PM_{2.5}$ emissions Meets air quality standards	20,810 tons Unlikely to exceed air quality standards	3,740 tons Meets air quality standards	21,170 tons Unlikely to exceed air quality standards	8,170 tons Unlikely to exceed air quality standards	20,790 tons Unlikely to exceed air quality standards
Fuels and fire	Percent of area in surface fire, passive crown fire and active crown fire type.	Surface 79% Passive 16% Active 5%	Surface 49.9% Passive 33.1% Active 17%	Surface 77.8% Passive 15.4% Active 6.8%	Surface 71.8% Passive 23.2% Active 5%	Surface 79.1% Passive 15.9% Active 5%

Objective or Issue	Key Measure	Alternative 1 Proposed Action	Alternative 2 No Action	Alternative 3 No Temporary Roads	Alternative 4 No Prescribed Fire in Mechanical Treatment Areas	Alternative 5 No Mexican Spotted Owl Amendments
Roads and engineering	Increase in traffic for project activities (round trips)	12 round trips	1 round trip	11 round trips	12 round trips	12 round trips
Roads and engineering	Develops gravel pits for improved road maintenance	Yes	No	Yes	Yes	Yes
Visual quality and scenery management	Effects to Visual Quality Objectives / Scenic Integrity Objectives	Some short-term effects	None expected	Some, Short term	Some short-term effects in areas treated with prescribed fire, much longer in mechanical treatment areas from slash.	Some short-term effects
Visual quality and scenery management	Improve scenic stability	Yes	No	Yes	Yes	Yes
Social science and economics	Estimated jobs created	229-249	168-191	226-246	218-237	229-252
Vegetation	Move the landscape towards desired conditions (VSS) Acres	29,880	880	28,030	29,880	29,880
Vegetation	Wood volume made available for removal annually- trees greater than 5-inches diameter (CCF)	29,600	1,900	27,500	29,600	32,300
Wildlife, fish, and rare plants	Mexican spotted owl	May affect, likely to adversely affect	May affect, not likely to adversely affect	May affect, likely to adversely affect	May affect, likely to adversely affect	May affect, not likely to adversely affect

Objective or Issue	Key Measure	Alternative 1 Proposed Action	Alternative 2 No Action	Alternative 3 No Temporary Roads	Alternative 4 No Prescribed Fire in Mechanical Treatment Areas	Alternative 5 No Mexican Spotted Owl Amendments
Wildlife, fish, and rare plants	Addresses primary threat to Mexican spotted owl	Yes	Some	Yes	Yes	Some
Wildlife, fish, and rare plants	Jemez Mountains salamander	May affect, likely to adversely affect	May affect, likely to adversely affect	May affect, likely to adversely affect	May affect, likely to adversely affect	May affect, likely to adversely affect
Wildlife, fish, and rare plants	Addresses primary threat to Jemez Mountains salamander	Yes	No	Yes	Yes	Yes

Chapter 3. Affected Environment and Environmental Consequences

About this Chapter

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 here. Only summaries are provided for each resource and all resource reports are incorporated by reference. Most specialist reports will be available for viewing on the Southwest Jemez Mountains Restoration Web page. Those documents not on the Web site can be made available upon request.

How We Determined Effects of the Proposed Action and the Alternatives

Chapter 2 introduced the "toolbox" approach which described how the project activities would be implemented on the ground based upon landscape features and design criterion. This was done because the traditional approach to NEPA simply lacks the flexibility to achieve desired conditions at the landscape level. At this level, rather than local-level treatments, such as a stand prescription, treatments will be guided by what we find on the ground (like selecting a tool from the toolbox). This has come to be known as the toolbox approach. In this approach we use landscape features (what we encounter on the ground) and design criteria (the tools) as a more flexible way to achieve our desired conditions.

The interdisciplinary team started with a group of landscape features; these are areas that we will potentially treat throughout the project area. Examples of landscape features are cover types, slope, scenic sensitivity levels, and threatened and endangered species habitat. Then the interdisciplinary team developed design criteria. Design criteria are limits on the treatments, or tools, that we will apply to any of those landscape features. For example, on cultural resource sites we will use directional felling to keep trees from falling on rubble mounds. An advantage of this approach is that we can monitor effects of the individual and cumulative actions and make changes to the design criteria or mitigations if the effects differ from what we predicted. The toolbox approach applies to all action alternatives.

To determine how the proposed actions would affect a particular resource the interdisciplinary team selected potential treatment areas within the project bounds (polygons) based on specific landscape features (e.g. slope, cover type, habitat for threatened and endangered species). Design criteria were then applied to these potential treatment areas and the effects to the various resources were modeled. It is important to note that the polygons were used as a tool for the analysis rather than being prescriptive (that a particular treatment will occur on a particular acre).

The actual areas to be treated and the treatments themselves will be determined based on conditions encountered on the ground. The actual effects of the actions will be monitored. Based on the monitoring results we can determine if the model accurately projected the effects and what changes to the design criterion or mitigation measures may be needed to keep the effects within the limits of what was projected. This adaptive approach will give the implementation team a lot more flexibility to achieve the desired conditions described in chapter 1 rather than being constrained by the accuracy of the data used for the analysis.

Air Quality

The air quality specialist report (Hall 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations.

Affected Environment

The Southwest Jemez Mountain Landscape Restoration Project proposes several actions that could affect air quality in the surrounding communities. The primary concern from an air quality perspective is the impacts on public health from smoke produced from proposed prescribed fires.

The term wildland fire is used here. Wildland fire refers to any non-structure fire that occurs in the wildland and can be a prescribed fire or a wildfire. Wildland fire is used when the distinction between a prescribed fire and a wildland fire is not necessary.

Description of the Airshed[5]

The project area is located within the Middle Rio Grande Airshed (NMED 2003). This airshed includes all or part of Bernalillo, Cibola, McKinley, Sandoval, Socorro, and Valencia Counties. There are two Class 1 areas within 50 miles of the project area, Bandelier National Monument, 15 miles to the east, and San Pedro Parks Wilderness, approximately 25 miles northwest of the project area. Under the Clean Air Act, Class 1 areas require the highest level of protection for both National Ambient Air Quality Standards (NAAQS) and visibility.

Topography, Winds, and Smoke-Sensitive Areas

The topography, wind patterns, and air inversions of the Southwest Jemez Mountains area have a strong influence on smoke impacts. The prevailing winds in the Jemez Mountains area typically blow from southwest to northeast (southwesterly winds) during the day and then reverse direction overnight. Winds in the spring and summer are stronger during the day and weaker overnight. This pattern reverses in the fall. Stronger down drainage airflows typical of the fall season are coupled with strong inversions that tend to trap cool air close to the surface through the evening and into the morning. This generally doesn't happen during the spring and summer when any cool air is dispersed quickly once the sun heats up the valley floors. The topography of the area also affects where smoke goes. Smoke from all sources- woodstoves, prescribed fire, or wildfires- tends to settle in the Jemez River Valley drainages at night.

Smoke-sensitive areas[6] are places or resources that may be sensitive to smoke impacts. These areas include populations or specific places, views, hospitals, airports, schools, highways, or businesses that would likely be affected by smoke coming from the project area. For this project, specific smoke-sensitive areas were identified and considered in the analysis: the town of Ponderosa, Jemez Pueblo, San Yisidro, Jemez Springs, and Zia Pueblo. These communities would primarily be affected by smoke settling into the drainages at night. During the day, when southwesterly winds predominate, the communities most likely to be impacted are Los Alamos and White Rock.

Generally those communities closest to a given project, particularly those down drainage, would receive the greatest impacts from smoke. However, smoke could impact communities in

[5] An airshed is the air supply of a region, which may become uniformly polluted or stagnant.
[6] Smoke-sensitive areas are also called smoke-sensitive receptors.

Bernalillo County and the Middle and Upper Rio Grande Valley, including the cities of Rio Rancho, Albuquerque, Santa Fe, Los Alamos, and Española.

Key Components of Smoke from Wildland Fires

Smoke is a mixture of fine particulates and gases. It also contains a wide range of pollutants, which can remain suspended in the atmosphere anywhere from a few seconds to several months. The pollutants that would be found in smoke from a wildfire include carbon dioxide (CO2), particulate matter (PM), nitrogen oxides (NOx), and hydrocarbons. Particulate matter has the potential to impair visibility and human health. Lead, sulfur dioxide, and other compounds can also be found in smoke but they occur in very small amounts and are less of a concern in regards to human health. Ozone may also be present. While many of these pollutants, as well as some toxic pollutants, are present in smoke from prescribed fires and wildfires, particulate matter 2.5 (PM2.5) is the pollutant of greatest concern and is the most likely to result in public health impacts.

Particulate Matter 2.5 (PM2.5)

Particulate matter 2.5 is a criteria pollutant and is produced by all types of burning including power plants, combustion engines, woodstoves, and wildland fire. It is a major component of wood smoke and is produced in large quantities in wildland fires. Because of its small size, PM2.5 is dispersed great distances and can become embedded deep in the lungs. PM2.5 can cause serious health impairments, especially in individuals with pre-existing respiratory and circulatory system health issues. Exposure to PM 2.5 is associated with premature death, heart attacks, and stroke (Pope 2002, 2004; Brook 2004) and can trigger asthma attacks (Sheppard 1999; Delfino 2009; Elliott 2013). In contrast, PM10 causes eye, nose, and throat irritation, but remains in the upper respiratory tract because of its relatively larger size.

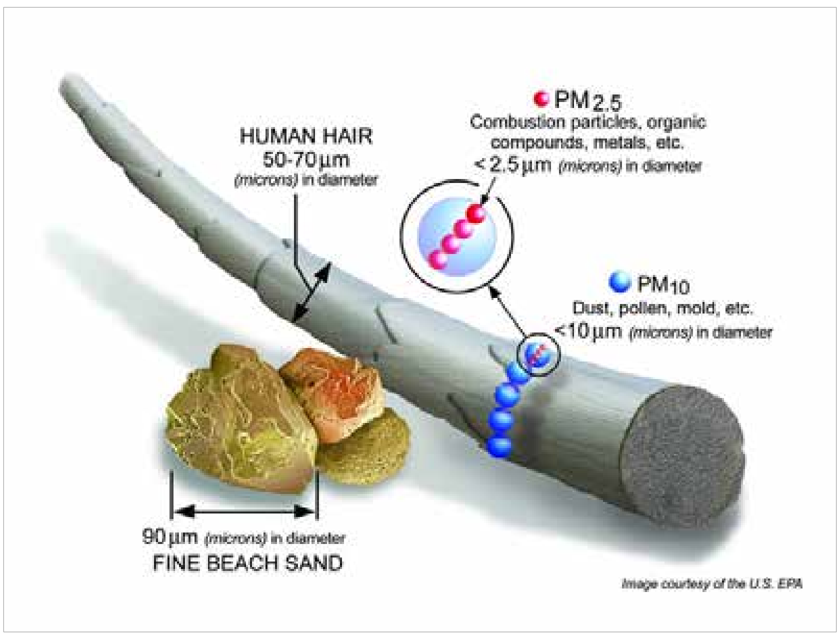

Figure 22. Relative size of PM2.5 particles as compared to fine beach sand, a human hair, and PM10 particles.

Ozone

Ozone has been associated with smoke from prescribed fire and wildfire. It is not directly produced by wildland fires, but the chemical compounds that form ozone- nitrogen oxides and volatile organic compounds- are found in wood smoke. Through a complex process, these compounds can react with each other and produce ozone. Wildfires have been shown to contribute to ozone concentrations downwind; however, predicting this is a challenge (Jaffe and Widger 2012). The biggest sources of the precursors to ozone in the general area are two power plants near Farmington, engine exhaust from oil and gas development, and mobile sources including cars, trucks and recreational vehicles. Ozone has also been shown to result in a number of health effects and symptoms across a wide range of the population. Ozone can induce respiratory symptoms such as coughing, pain, discomfort, and tightness in the chest, inflammation of the lung, loss of lung function, and asthma attacks (USEPA 2012b).

Carbon Monoxide

Carbon monoxide is another major product of wildfire smoke. Because it is a gas, it is quickly diluted in the atmosphere. Carbon monoxide can be of concern to firefighters in the immediate vicinity of any wildfire or prescribed fire because they are working quite close to the source of the smoke. But in general it has little impact away from the immediate project area.

Existing Conditions for Air Quality and Visibility

This section evaluates and compares the existing and reference conditions of the air resource within the project area, specifically regarding pollutants and visibility. Reference conditions refer to the national and state standards for managing air quality. The Clean Air Act (as amended) requires the Environmental Protection Agency (EPA) to set NAAQS for pollutants considered harmful to public health and the environment. The New Mexico Environment Department (NMED) is responsible for regulating NAAQS pollutants in New Mexico to protect human health and welfare.

Air Quality

Air quality within and around the project area is generally excellent and meets all national air quality standards, including those for the six criteria pollutants: lead, sulfur dioxide, nitrogen dioxide, ozone, carbon monoxide, and particulate matter (PM10 and PM2.5). This area is not listed as a non-attainment[7] area (USEPA 2012a). There is some concern, however, about elevated ozone levels in the Albuquerque metro area, and there have been smoke impacts from wildland fires near the project area in recent years. Regarding wildland fire, the criteria pollutants of concern are ozone and PM2.5, which are being monitored in the project area.

There have been some notable smoke impacts from wildland fires over the last several years in many of the potentially affected communities. The Wallow fire in Arizona (2011) and the Las Conchas fire (2012), adjacent to this project area, had significant smoke impacts. For example, Albuquerque, which is over 150 miles away from the Wallow fire, had notable smoke impacts for several days: the 24-hour standard for PM2.5 was exceeded over several days in June 2011.

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[7] As defined by the Clean Air Act, a non-attainment area is one that does not meet the standards for one or more of the six criteria pollutants.

There are several air quality monitoring stations in the vicinity of the project area: a monitor for ozone and particulate matter (PM2.5) on the Pueblo of Jemez south of the project area, and two air quality monitoring sites located in the Middle Rio Grande Valley (figure 23). Although these monitors are strongly influenced by emissions from the Albuquerque area, they were selected for use because smoke from prescribed fires can affect nearby areas. Air quality on the forest is likely to be better than indicated because there is less influence from the metro area.

Visibility

Visibility relates to conditions that allow humans to see and appreciate the inherent beauty of the landscape, which can be greatly affected by the particular matter and gasses found in smoke or dust (Malm 2000). There are visibility monitors in each of the two Class 1 areas. The monitors at these stations measure aerosols and particulate matter that can contribute to reduced visibility. They also identify the chemicals and emissions responsible for human-caused visibility impairment (FLAG 2002).

The Regional Haze Rule sets a goal to return these areas to natural visibility conditions by 2064. As of 2010, both Class 1 areas were slightly ahead of schedule, but further improvements will be needed to meet the national visibility goal. In 2011, visibility was impacted at both monitoring locations as a result of smoke from the Las Conchas and Wallow fires. The Cerro Grande Fire (2000) also resulted in bad visibility days.

Effects of Past Wildland Fire Events on Air Quality

Short-term elevated PM2.5 concentrations result from both prescribed fires and wildfires. There have been incidences of unhealthy air quality in the area based on the air quality index (USEPA 2013) from both wildfire and prescribed fire in the past several years. Wildfires often have greater impacts than prescribed fire, both in terms of concentrations and duration of impacts of PM2.5 concentrations.

Large wildfires in 2011, notably the Wallow fire in Arizona and the Las Conchas fire, adjacent to this project area, had significant smoke impacts. For example, in Albuquerque, over 150 miles away from the Wallow fire, there were several days in June 2011 when the standard of 35 micrograms per cubic meter of air (ug/m3) for PM2.5 was exceeded.

Los Alamos and many of the Pueblos downwind from the fire also experienced significant impacts from smoke due to the Las Conchas wildfire. Smoke impacts were worse than the Wallow fire. For example, there were several days when the 1-hour averages for PM2.5 in Los Alamos during the Las Conchas fire were 2-5 times higher than the highest days in Albuquerque during the Wallow fire. Most of these differences can be attributed to the proximity of the wildfires.

Typically, the most significant impacts from smoke are associated with wildfires, but there have been large smoke impacts from prescribed fires. In October 2012, the Santa Fe National Forest conducted two prescribed fires near the proposed project area in the Jemez Mountains. Smoke from these burns resulted in impacts in nearby communities and Albuquerque. With each burn, there were 2-3 days of elevated concentrations PM2.5 in Albuquerque, but they did not exceed the standard of 35 ug/m3. During the first burn, impacts were significantly higher in the town of Ponderosa, directly below the prescribed fire. The 24-hour average for PM2.5 peaked at more than four times the standard. There were also reports of elevated smoke in the Jemez Pueblo during the second burn. Air quality alerts were issued during both of these fires.

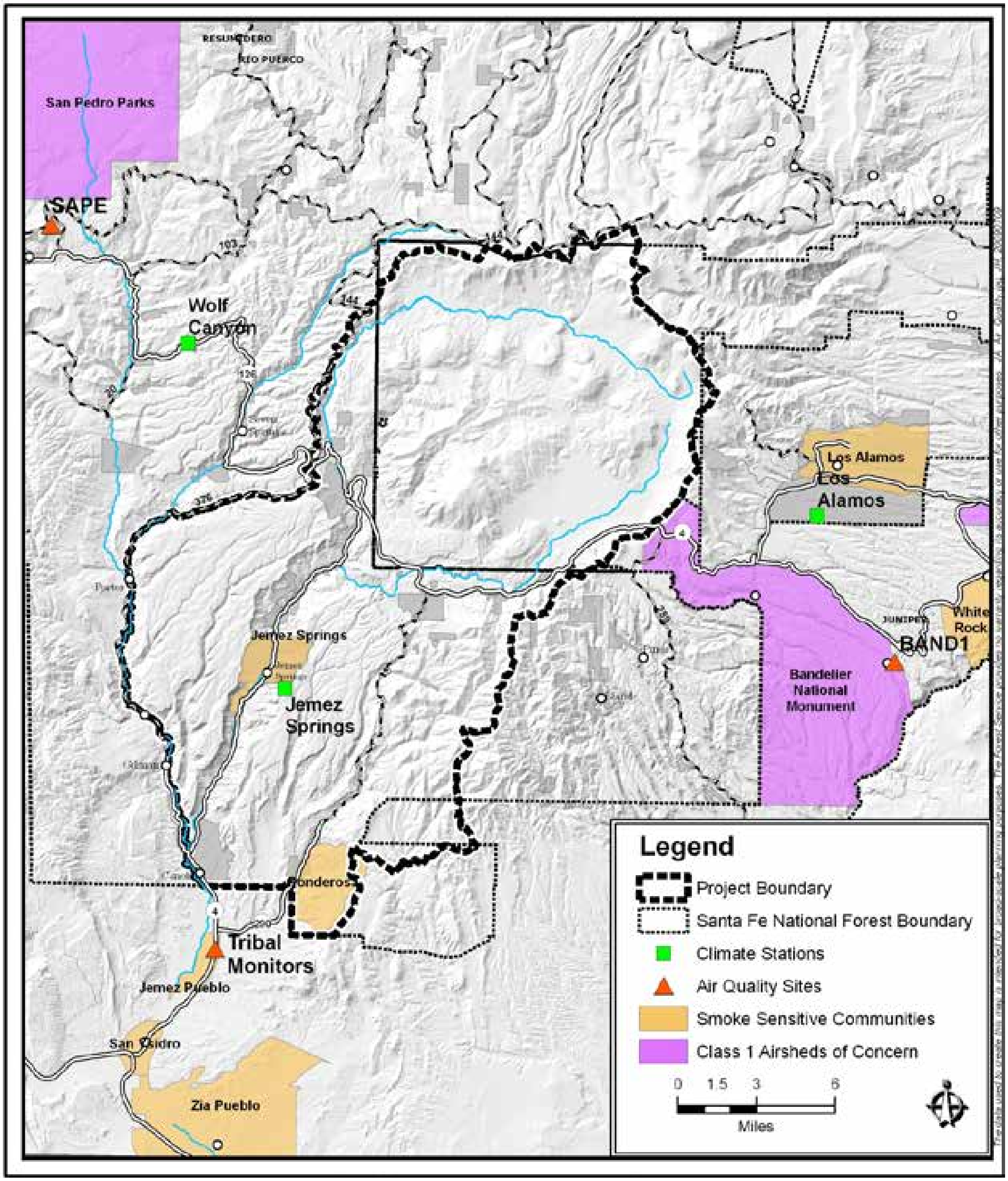

Figure 23. Locations of air quality monitoring sites, climate stations, smoke sensitive communities, and Class 1 Airsheds of Concern

No significant impacts to ozone concentrations occurred as a result of the wildfires or prescribed fires described above in the communities in the project area or the Albuquerque and Santa Fe metro areas. Impacts to ozone levels as a result of wildland fire were not considered as part of this analysis. This is because of the complexity and uncertainty of modeling ozone from wildfires and because no impacts have been noted in recent years from wildland fire events.

Methodology

Consume v. 3.0 (Ottmar et al. 2006) was used to model potential emissions of PM2.5 and carbon dioxide produced by each alternative. A scenario involving wildfire was also modeled. The wildfire scenario had the same footprint (area) as the prescribed fire alternatives.

Consume is a fuels model commonly used to estimate emissions. The model uses the following data to calculate emissions: fuel type(s), the type of fire (prescribed fire or wildfire), the condition of the unit (has it been mechanically treated or is the fire simulating a natural broadcast burn), and environmental conditions (fuel moisture). The model then estimates emissions for a variety of pollutants, including PM2.5 and carbon dioxide. The complete set of assumptions and outputs for all pollutants modeled is in the air quality specialist report in the project record.

The following pollutants and emissions were not analyzed because there is a high degree of uncertainty associated with analyzing these:

- Toxics known to be present in smoke such as metals, including mercury; radionuclides; and byproducts of fire accelerants. This is due to the high level of uncertainty in such an analysis in terms of quantifying the amounts produced, the estimated concentrations downwind, and health impacts, especially when significant impacts have been shown from particulate matter from smoke from wildfires and prescribed fires.
- Vehicle emissions (exhaust) associated with roadwork and equipment used for mechanical treatments and harvesting wood. Also, air quality in the project area is considered to be very good and the relatively small amount of emissions from such actions would be considered negligible to the broader airshed. Finally, emissions from any of these actions would be reduced by federal fuel standards.
- Fugitive dust from road work and gravel pits. Air quality in the project area is considered to be very good such that the relatively small amount of emissions from such actions would be considered negligible to the broader airshed. Fugitive dust from any of these actions would be reduced by contractual requirements for operating and best management practices to reduce fugitive dust.

Analysis Question

The analysis question was derived from the purpose and need and the issues that arose during scoping as described in chapter 1.

- What are the impacts on public health and air quality from the proposed prescribed fire treatments?

Summary of Effects

All of the alternatives will produce smoke. Alternatives 1, 3, and 5 produce about the same amount of smoke emissions. Alternative 4 produces about 39 percent of the smoke emissions of alternatives 1, 3, and 5. Alternative 2 produces the least, about 19 percent of alternatives 1, 3, and 5. Smoke from prescribed fires would have short-term adverse effects on air quality, visibility, and health. The relative risk is related to the total amount of emissions produced by each alternative. Impacts on human health are due to exposure to PM2.5. The communities that would be most affected by smoke are those in the Jemez River Valley.

Environmental Consequences

The following section analyzes the potential smoke emissions under each of the alternatives being considered. The primary environmental impacts to air quality analyzed are total emissions from prescribed fire for fine particulate matter (PM2.5) and carbon dioxide. PM2.5 is the pollutant from smoke that is a primary concern regarding human health impacts. Carbon dioxide was analyzed to represent the primary greenhouse gas emitted from wildland fire.

Emissions were evaluated instead of direct impacts to air quality impacts. This is due to the high degree of uncertainty associated with assessing impacts for future actions such as prescribed fire. The most significant factor affecting impacts to air quality is the meteorology (weather conditions) at the specific time a project is implemented. Specific weather conditions that are likely to occur at the time of the proposed prescribed fire treatments cannot be predicted at any given time. We also cannot be certain that each alternative could be implemented under identical conditions. Weather is not included as a variable in this analysis, because it would make evaluating any differences between alternatives irrelevant. To draw meaningful distinctions between alternatives, this analysis compares the modeled emission of various pollutants and holds weather conditions constant.

Effects Common to All Alternatives

Effects on Air Quality and Visibility

Air quality impacts are expected to be minimized under all of the alternatives because burning would be limited to days with good ventilation conditions[8]. Smoke would be noticeable during periods of burning, which could be expected to last for five to seven days. Fuels in the interior of the burn would smolder for several days afterwards. Emission reduction techniques would be used to reduce the actual amount of emissions produced from fire and help maintain air quality. These techniques are listed in appendix A.

Based on typical daytime winds in the area, smoke would likely move toward the northeast and would likely dissipate during the periods of active burning. During the day, the amount of smoke generated would tend to be greatest for a few hours in the late afternoon when the fire is hottest. However, people in the surrounding areas and in Albuquerque and Santa Fe would likely see smoke in the air.

In the evenings, it is likely that smoke would settle into canyons and stream valleys and would likely drain down into the community of Ponderosa and the Jemez River valley, potentially reaching the Albuquerque metro area. Thus, smoke would be most noticeable in the late evening and early morning hours. There could also be major impairments to visibility in portions of the Bandelier National Monument and San Pedro Parks Wilderness.

[8] Ventilation is the atmospheric potential to disperse airborne pollutants. Good ventilation conditions mean that the smoke will disperse quickly.

Effects on Public Health

There is a potential for significant health impacts from any of the alternatives because of exposure to PM2.5. The relative risk is related to the total amount of emissions produced under each alternative. The use of prescribed fire would be restricted on days with less than good ventilation conditions and emission reduction techniques would be required. As a result, the effects on air quality would be minimized because fewer emissions are produced.

High levels of particulate matter in smoke can impair visibility. Significant visibility impairment can lead to highway accidents or problems with planes landing at airports. If an uncharacteristically severe wildfire occurred, visibility along Highway 4 from Jemez Springs to Los Alamos and Highway 550 to Bernalillo could be reduced. This could result in a higher risk of traffic accidents, road closures, or other impacts to motorists along portions of New Mexico highways and local, private, and forest roads.

Amount of Particulate Matter and Carbon Dioxide Produced

Total smoke emissions are greatest under alternatives 1 (proposed action), 3, and 5; there is no significant distinction among the three alternatives. Emissions are least under alternative 2 (no action). Under alternative 2, estimated total emissions are approximately 19 percent of alternatives 1, 3, and 5. Alternative 4 would have approximately 39 percent of the total emissions of alternatives 1, 3, and 5. Emissions from a wildfire covering the same area treated with prescribed fire wear are higher than any of the alternatives.

Table 4 shows the estimated total tons of PM2.5 and carbon dioxide produced from the prescribed fire treatments under each alternative and from a wildfire. There is an important distinction between a wildfire and a prescribed fire. A wildfire would likely occur as a single event potentially lasting for several weeks in one year. The prescribed fire treatments in all of the proposed alternatives would occur incrementally over a period of approximately 10 years. Figures 24 and 25 present the same information in graphic form.

Table 4. Total tons of PM2.5 and carbon dioxide emissions produced for each alternative and from a wildfire. Alternatives 1, 3, and 5 produce about the same amount of emissions.

Alternative	Total Tons of PM2.5	Total Tons of Carbon Dioxide
Alternative 1	20,801	2,633,210
Alternative 2	3,644	504,723
Alternative 3	21,174	2,594,270
Alternative 4	8,168	1,172,849
Alternative 5	20,795	2,616,150
Wildfire	25,6441	3,286,462

The total emissions produced for each pollutant (see figures 24 and 25) is the best way to show differences among the alternatives; however, the tons per acre of emissions produced by each type of treatment are also important. As illustrated below, there are approximately 20,000 tons of PM2.5 emissions under alternatives 1, 3, and 5 and approximately 2.6 million tons of CO2 under alternatives 1, 3, and 5. Alternatives 1, 2, 3, and 5 have a combination of treatments: (1) prescribed fire alone and (2) mechanical treatments followed by prescribed fire. Alternative 4 only uses one treatment- prescribed fire on areas that have not been mechanically treated.

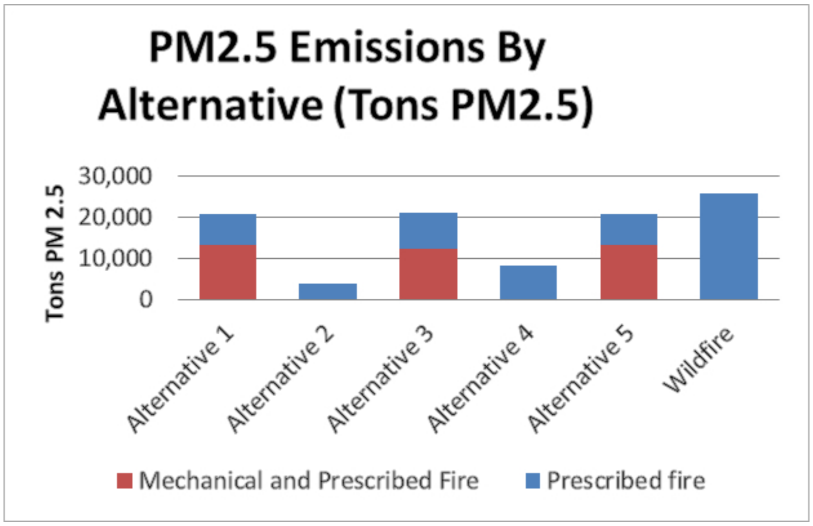

Figure 24. Particulate matter 2.5 (PM2.5) emissions in tons, for all alternatives and a wildfire. Alternatives 1, 3, and 5 produce the approximately the same amount of PM2.5. A wildfire produces the highest amount. Alternative 4 produces the least of all the action alternatives because fewer acres are burned.

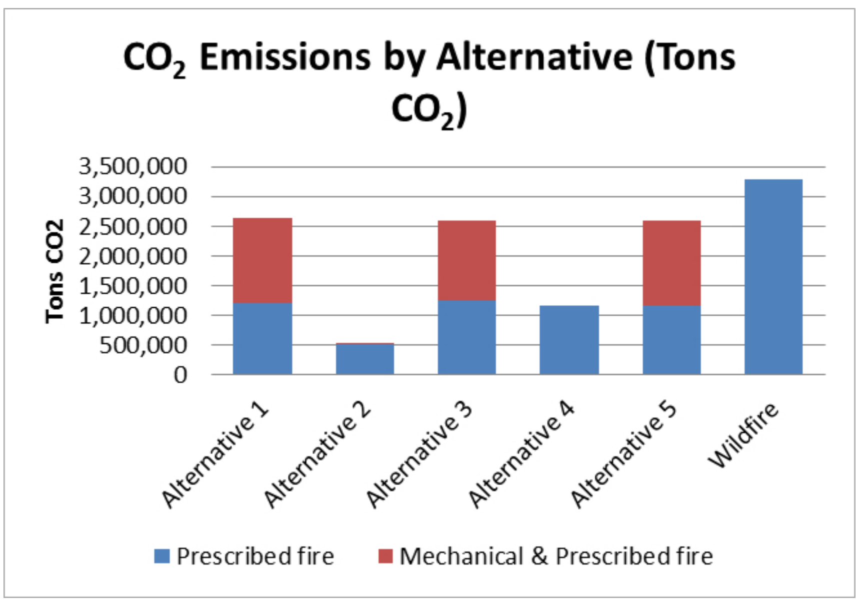

Figure 25. Carbon dioxide emissions produced, in tons, for all alternatives and a wildfire. Alternatives 1, 3, and 5 produce the same amount of carbon dioxide. A wildfire produces the highest amount. Alternative 4 produces the least of all the action alternatives because fewer acres are burned.

Figure 26 shows the average amount of PM2.5 produced in tons per acre under each alternative by treatment type.

- Approximately 20,000 tons per acre of PM2.5 were produced under alternatives 1, 3, 4, and 5 with prescribed fire alone.

- Approximately 42,000 tons per acre of PM2.5 were produced under alternatives 1, 3, and 5 with mechanical treatment followed by prescribed fire.

The estimated tons per acre of PM2.5 produced by each treatment type are fairly consistent among all the alternatives. The differences result from the different kinds and amounts of fuels and the treatment type used under each alternative. For example, under alternatives 1, 3, and 5 approximately 73 percent of the acres that are mechanically harvested and burned are the ponderosa pine fuel type. But under alternative 2, approximately 71 percent of the acres that are mechanically treated and then burned are the dry mixed conifer fuel type. Although the main driver of the differences in total emissions among alternatives is the total number of acres treated by fire, the average tons per acre vary considerably by treatment type.

The acres that have been mechanically treated and then burned produce the most emissions on a tons per acre basis. This is because of higher fuel loads from the slash or activity fuels left behind after mechanical treatments. Prescribed fire used in natural fuels (acres that were not previously harvested) produces the least amount of emissions on a tons per acre basis.

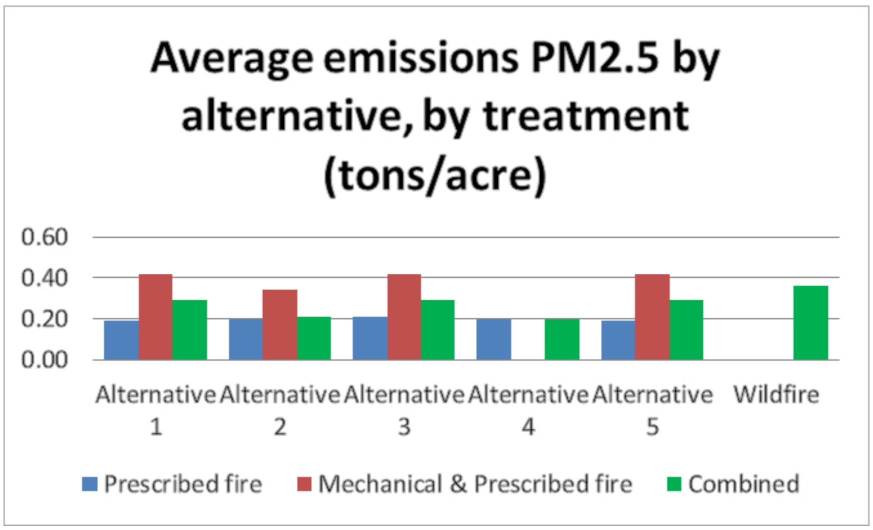

Figure 26. Average emissions of PM2.5 by alternative (tons/acre PM2.5). All alternatives produce about the same average amount of PM2.5 per acre under prescribed fire alone. Alternatives 1, 3, and 5 produce about the same amount of PM2.5 per acre on the acres that are mechanically treated and then burned. When the two treatments are averaged, alternatives 1, 3, and 5 produce about the same amount of PM2.5 per acre and alternative 2 produces the least. There is no combined treatment for alternative 4 because the acres mechanically treated are not burned.

Other pollutants were modeled by treatment type, but only PM2.5 emissions are shown because it is the pollutant of most significant concern. For the pollutants modeled, the total emissions for each pollutant varied, but they all followed the same pattern of emissions shown in figure 4:

Smoke and Dust Emissions from Mechanical Treatments

No smoke would be generated from thinning or wood and slash removal. There would be minor impacts to air quality from these activities: fugitive dust and exhaust from vehicles, heavy equipment, and chain saws. The levels of vehicle exhaust are anticipated to fall well below EPA emission standards. Road dust would be higher than current conditions when activities are taking place unless they are conducted when the ground is frozen or the road is moist. Road maintenance and decommissioning activities would also stir up dust. This kind of dust settles fairly quickly, can be mitigated with dust abatement techniques, and is limited to small, localized areas.

Forest Plan Amendments

The proposed amendments would have very small and insignificant effects on air quality under each alternative or among the alternatives. This is because of the small areas affected by the amendments. For example, under alternative 5 the change in emissions as compared to alternatives 1 and 3 was less than 1 percent. This amount of change is insignificant and does not allow for a meaningful distinction between the three alternatives. Since the air quality analysis examined effects at the project level, these amendments would have no effect of the results of the analysis and have insignificant effects on air quality.

Cumulative Effects

The analysis area for considering cumulative smoke-related effects is the portion of the Middle Rio Grande airshed. It is not necessary to analyze all the activities within the entire Middle Rio Grande airshed. The relatively short-term duration of smoke emissions from this project would not affect long-term air quality in the area. The treatments may actually mitigate the effects on air quality from a wildfire.

Cumulative effects include those from past, ongoing, and reasonably foreseeable future activities that combine with effects of the proposed project in contributing to the total particulate matter, carbon dioxide, and ozone load in the same airshed. There is no large industry capable of contributing significant amounts of particulate matter or carbon dioxide within the analysis area for cumulative effects. Other potential sources and amounts of these pollutants and their contribution cannot be accurately quantified. They include:

- Use of fireplaces and wood stoves contributes particulate matter and carbon dioxide, mostly from November to April
- Dust from unpaved roads does not typically travel very far or contribute large amounts of particulate matter
- Industry emissions are a negligible contribution
- Prescribed fire treatments by agencies and private landowners are a common contribution of particulate matter and carbon dioxide
- Wildfires usually occur annually and contribute relatively large amount of particulate matter and carbon dioxide

Thus, the amount of pollutants that would be distributed to areas downwind of the project area would increase when all sources of emissions are considered. These sources are: (1) emissions from prescribed fire activities outside the project area; (2) emissions from the other sources in the list above; and (3) the existing particulate matter and carbon dioxide in the air from past activities.

Fireplace smoke and prescribed fires would be the primary contributors to cumulative air quality effects because they are the most common sources of particulate matter and carbon dioxide. Fall and winter burning of slash piles in the project area and in the surrounding forests would contribute incrementally to the cumulative smoke effects from residential use of wood stoves and fireplaces.

Fine particulate emissions (PM2.5) from the proposed action combined with other sources of PM2.5 would add to the regional haze that results when there are multiple sources of emissions during the same time period. The proposed actions would contribute an insignificant amount of fine particulate matter to the regional haze and overall air pollution load within this airshed. This is due in part to the timing, coordination, and monitoring of the proposed actions, the low emissions concentrations, and other mitigation measures previously described.

Although prescribed fires could occur at any time of the year, most of the broadcast burning would not occur during the winter. In winter, the meteorological (weather) conditions that allow slow-moving colder air to settle in low-lying areas are more likely to occur. These low-lying areas are often more populated. Larger prescribed fires are not typically conducted during these conditions due to the concern that smoke will pool in high concentrations in these areas, potentially resulting in health impacts. The State also imposes restrictions on when prescribed fire can be used to allow for adequate smoke dispersal.

To further reduce cumulative effects on air quality, prescribed burning would be coordinated between federal land managers and the New Mexico Environment Department. The State has regulatory authority and can decide if and when a prescribed fire can take place. Postponing or stopping a prescribed fire could be done to avoid putting too much smoke in the air and exceeding air quality standards. Thus overall, the cumulative increase in emissions from this project is not expected to be significant enough to approach concentrations that would exceed State or Federal air quality standards. also important. Alternatives 1, 2, 3, and 5 have a combination of treatments: (1) prescribed fire alone and (2) mechanical treatments followed by prescribed fire. Alternative 4 only uses one treatment- prescribed fire-in areas that have not been mechanically treated.

Conclusions about the Effects on Air Quality

The analysis question is answered here.

What are the impacts on public health and air quality from the proposed use of prescribed fire?

- There is a potential for significant health impacts from any of the alternatives because of exposure to PM2.5. The relative risk corresponds to the total amount of emissions produced from each alternative as shown in figures 24 and 25.
- The effects on air quality would be minimized using the emissions reductions techniques in appendix A. Some of the key measures for reducing smoke impacts on health are (1) conducting prescribed fires when ventilation conditions promote good smoke dispersal; (2) communication and coordination with affected communities prior to and during prescribed fires and (3) using air monitors to assess impacts on communities likely to be affected by the prescribed fires and then adjust accordingly if significant impacts occur.
- Other measures listed in appendix A would reduce the amount of emissions produced by up to 45 percent and would help maintain air quality.

Climate Change

Affected Environment

Climate scientists unequivocally agree that the earth’s climate is getting warmer at an unprecedented rate, and that this is primarily a result of humans burning fossil fuels and land use changes. The burning of fossil fuels and land use changes has caused elevated levels in atmospheric concentrations of carbon dioxide (CO2) and other greenhouse gases (IPCC 2013). The observed concentrations of these greenhouse gases are projected to increase. Climate change will likely intensify the risk of ecosystem change for terrestrial and aquatic systems, affecting ecosystem structure, function, and productivity (USDA 2010).

Southwestern ecosystems have evolved under a long and complex history of climate variability and change. Considering the mega-droughts and other climate related variation that has occurred over time, southwestern systems have some built-in resilience. However, between 1984 and 2006, an estimated 18 percent of southwestern coniferous forest was lost to increased fire and bark beetle outbreaks likely resulting from drought and high average temperatures (Williams et al. 2010).

This analysis synthesizes the direct and indirect environmental consequence information from the specialist reports (as applicable). The Southwestern Region Climate Change Trends and Forest Planning (USDA 2010) report is incorporated by reference. See the specialist reports for effects and cumulative effects analyses that consider climate.

Influences on Climate in the Southwest

The climate of the southwestern United States is often referred to as dry and hot; however, it is very complex. The low deserts experience heat and drying winds in the early summer, but forested mountain areas and plateaus may experience cold and drifting snow during winter. Climate variability is the norm within this region, as temperature and precipitation fluctuate over seasons and centuries. The major feature that sets climate of the Southwest apart from the rest of the United States is the North American monsoon, which, in the U.S., is most noticeable in Arizona and New Mexico. Up to 50 percent of the annual rainfall of Arizona and New Mexico occurs as monsoonal storms from July through September (Sheppard et al. 2002; USDA 2010).

Many factors affect climate in the Southwest during a particular year or season, but predictable patterns hold across the years and decades and define the region’s climate. In summary:

The overall aridity relates to a global circulation pattern known as Hadley circulation, which creates a semi-permanent, high pressure zone over the Southwest

- Relatively high temperatures with dynamic daily swings define this geographic region
- Mountains and other differences in elevation affect local climate patterns
- The North American Monsoon works to bring moisture from the tropics into the region during the summer months (USDA 2010)

Based on current projections, the primary regional level effects of climate change most likely to occur in the Southwest include: warmer temperatures, decreasing precipitation, decreased water availability with increased demand, and increased extreme disturbance events. These climate change factors could, in turn, affect ecological, weather related disturbances, and socioeconomic demands (USDA 2012), including increases in:

- Frequency of extreme weather events (intense storms);
- Wildfire risks;
- Outbreaks of insects, diseases, and spread of nonnative invasive species;

- Water scarcity and extended droughts coupled with increased demand;
- National forest socioeconomic uses and demands; and
- Changes in habitat quality and quantity for certain desired wildlife and plant species

Threats to Local Resources

The goal of this project is to restore ecosystem structure and function and increase resilience to undesirable, large-scale disturbances such as climate change. A state-wide climate change vulnerability assessment identified the Jemez Mountains area as having both a high exposure to climate change impacts and high density of species vulnerable to climate change compared to other parts of New Mexico (TNC 2008). Much of the forested acres in the project area have reduced resiliency, which increases the potential for severe effects from wildfire, density-related mortality in trees, and reduced resiliency to insect and disease. Currently, about 50 percent of the project area could sustain high-severity effects from a severe wildfire. Treatments have been designed to increase forest resiliency and sustainability. Resiliency should increase the ability of the ponderosa pine forest in the project area to survive natural disturbances such as fire, insects and disease, and the extreme weather events associated with climate change. Other resources at risk in the project area include:

Soils and Watersheds: Uncharacteristically severe wildfires could result in a loss of soil productivity and sediment delivery to connected stream courses. Decreased soil moisture due to less precipitation expected from climate change and impaired or unsatisfactory soil conditions from wildfire events may lead to an overall decrease in long-term soil productivity. There may also be a loss of sequestered carbon through burning of the overstory and increased erosion rates.

Recreation Settings: Desired recreation setting characteristics such as large, mature trees, healthy understory, and diversity of tree age classes, sizes, and species would be at high risk from the effects of climate change. Unmanaged forests have shown increases in tree stress and mortality as a result of global warming, and old, mature trees are especially vulnerable (Ritchie 2008, VanMantgem et al. 2009, Williams et al. 2010). A greater risk of wildfire would increase the risk of damage and/or loss of recreational sites and facilities.

Fire Frequency and Carbon Storage: Woods et al. (2012) found that, although fire frequency affected the rate and total amount of carbon storage in a ponderosa pine forest, both 20-year and 10-year fire return intervals produced forests that were net carbon sinks, while the no action alternative forest became a net carbon source. Climate change has the potential to affect fire frequency and carbon storage (Woods et al. 2012).

Nonnative and Invasive Plants: Climate change is expected to be a source of widespread disturbances, and disturbance is a major factor in the spread of nonnative and invasive plants. Higher temperatures would occur and precipitation cycles would be modified from current patterns over large areas.

Rare and Endemic Plants: As environmental conditions change, the ability of rare and endemic plant species to adapt may be negatively affected. Water availability may decrease in some areas while temperatures generally increase. Climate change, coupled with other factors such as habitat loss, could lead to extirpations and increased risks of extinction.

Strategies to Address Climate Change

The Southwestern Region of the Forest Service developed a strategy to address climate change (USDA 2010). Actions include:

- Enhance adaptation by anticipating and planning for disturbances from intense storms
- Reduce vulnerability by restoring and maintaining resilient native ecosystems
- Increase water conservation and plan for reductions in upland water supplies
- Anticipate increases in forest recreation
- Use markets and demand for wood and biomass for restoration, renewable energy, and carbon sequestration
- Monitor climate change influences

The Southwest Jemez Mountains project incorporates several of the above actions. For example, proposed treatments including creating groups of trees with openings, returning fire to the landscape, and improving soils and watershed conditions. These treatments would restore and maintain resilient native ecosystems.

Analysis Questions

The scope of this analysis is confined to the project area. This scale is most relevant to the questions (USDA 2009) addressed by the analysis:

- What are the effects of project activities on climate change?
- What are the effects of climate change on resources and ecosystems in the project area?
- Would the treatments increase resilience and mitigate the effects of climate change on the landscape?

Environmental Consequences

Alternatives 1, 3, 4, and 5

Air Quality

During the public involvement period, people expressed concern that the proposed use of prescribed fire would contribute to global climate change by adding carbon dioxide and other greenhouse gases into the atmosphere. The analysis shows that carbon dioxide and greenhouse gases would be produced under each alternative, primarily through the use of prescribed fire. The analysis also demonstrated that the amount of carbon dioxide and greenhouse gases produced by a wildfire that burned the entire project area would be greater than any of the alternatives. The amount of greenhouse gases produced under any alternative is small on a global scale and calculating its impact would be very complex and is beyond the scope of this analysis. However, the release of carbon dioxide and greenhouse gases from fire, addresses only one major output of greenhouse gases and does not consider the forests ability to absorb greenhouse gases under each of the alternatives.

The capacity of the forest to absorb carbon in its biomass (trees and other vegetation) or release it through decomposition was not modeled. However, research on forest treatments and carbon loss or absorption demonstrates that forests that are thinned and treated with prescribed fire:

- Produce significantly less greenhouse gases initially, as compared to a wildfire;
- Will start absorbing more carbon than they produce within a couple years after treatment; and
- Are more resilient to large-scale disturbances that are likely to result from the forecasted warmer drier climate than those that have had uncharacteristically severe wildfires.

Treatments, such as prescribed fire and mechanical thinning, would result in an initial loss of carbon. This loss of carbon is less than what would happen with an uncharacteristically severe wildfire. After a high-severity wildfire, forests release carbon into the atmosphere for decades afterwards, even after the initial loss of carbon in smoke (Dore 2012). In contrast, within a few years after mechanical treatment and prescribed fire treatments, forests act as carbon "sinks" and absorb more carbon dioxide from the atmosphere than they release (Dore 2012; Fulé 2012; Honig 2012; Stephens 2012).

Cultural Resources

The proposed archaeological site treatment work primarily consists of cutting trees on archaeological sites by with chainsaws. The emissions produced by the chainsaws would not contribute to climate change in any measurable way. The fuels reduction treatments on archaeological sites have been designed to make the sites more resilient to current threats and potential future threats due to a changing climate (i.e. warmer and drier environment) versus doing no treatments.

Fuels

Climate change is affecting the size, frequency, and severity at which wildfires burn in the western United States (Westerling et al. 2006). Predictions include a longer fire season and increased risk of high-severity wildfire. The current ecosystem conditions found under the no action alternative leave approximately 50 percent of the project area at high risk for active and passive crown fire. The high-severity fire effects related to this type of fire behavior increase the potential at which carbon stocks would be released into the atmosphere.

Alternatives 1 and 3 use prescribed fire at low to moderate severities, reducing the amount of carbon released into the atmosphere as compared to the no action alternative. Alternative 4 includes about the same amount of mechanical treatment as alternatives 1 and 3, but reduces the use of prescribed fire by 41 percent. This reduction in prescribed fire increases the potential for passive crown fire as compared to alternatives 1 and 3. Overall, the long-term effects of low to moderate severity fire encourage larger fire resistant trees and lower stand densities, which lead to greater carbon storage (Hurteau and North 2009).

Nonnative and Invasive Plants

Under alternatives 1, 3, 4, and 5 the potential spread of nonnative and invasive plants caused by ground disturbance would be reduced by use of the design features, mitigation measures, BMPs, and invasive plant treatments. Increasing forest resiliency and function within the project area would diminish the impacts of climate change.

Nonnative and introduced species are a problem now because they can adapt better and out-compete native vegetation within their own present day ecosystems. With less precipitation, warmer climates and areas more susceptible to wildfires, nonnative species would have a greater advantage and would out-compete and replace native vegetation.

Rangeland Resources

Adaptive management is currently used and will continue to be used to match forage production with livestock numbers. Less precipitation is predicted under climate change, and water availability for livestock will decrease. Much of the range within the project area is only capable for grazing because of the existing water catchments, i.e. earthen tanks, trick tanks and spring developments. The mechanical treatments and prescribed burning would produce more forage within the upland areas but, with less available water, areas of available forage for livestock would decrease. The potential for wildfires with severe effects would increase. Soil loss from post-fire flooding and erosion would hinder ecosystem recovery. Grasses and forbs would establish and there would be more available forage than currently found.

Recreation

The action alternatives would improve forest structure, composition, and diversity, and resilience. This would reduce the risk of losing desired recreation setting characteristics such as large, mature trees, a healthy and diverse understory, and diversity in tree age classes, sizes and species.

Roads

The action alternatives would reopen and maintain closed roads and decommission nearly 100 miles of roads. As part of these activities the drainage on the roads will be improved. Climate change predicts more intense rainfall events and these improvements should reduce soil loss associated with roads as a result of these storms.

Scenery

The action alternatives would improve forest structure, composition, and diversity, and resilience. This would reduce the risk of losing desired valued scenery attributes such as ponderosa pine and mixed conifer forests, large, mature trees, aspen stands.

Social Science, Economics, and Environmental Justice

The proposed treatments would improve ecosystem resilience and reduce fire hazard. This would provide protection against damage to homes, communities, ecosystem services, community water supplies, and economic values such as livestock grazing, wood products, and ecosystem services. The treatments would also enhance the sustainability of traditional uses, traditional cultural properties, and cultural sites.

Climate change would have long-term impacts on many of the amenities, resources, and ecosystem services provided by the Southwest Jemez Mountains landscape. This includes the distinctive scenery and resources used by Native American and traditional Hispanic communities, the quantity and quality of water, and the amount and type of wood products. A changing climate could affect jobs and income related to recreation, tourism, and hunting. Businesses related to hiking and camping may have increased income and employment due to longer seasons. Water and snow-based activities and related businesses would decline. Loss of forests due to wildfires or type conversion would reduce the amount and type of wood products for personal and commercial use. Jobs and income related to forest products would also decline. Wildfires and weather-related disturbances such as floods and landslides could damage roads, houses, community water supplies, and other infrastructure

Soil and Water Resources

The action alternatives would move toward a more sustainable carbon sequestration scenario for the project area, especially for soil carbon. The road decommissioning, headcut treatments, and instream aquatic habitat improvement treatments would reduce erosion and could maintain or increase soil carbon levels (Neary et al. 2012). Increased storage of carbon in the soil, soil organic matter, and understory vegetation would reduce the potential loss of carbon stored in trees from wildfire (Neary et al. 2002; Stephens et al. 2012).

The mechanical treatments would improve soil condition and productivity for soil infiltration and nutrient cycling because an increase in grass species results in a larger root network. These root networks are essential to loosening up and improving the soil structure and promote better water infiltration, air exchange, and nutrient cycling. These actions improve the ability of the soil to store water, which in turn would mitigate the potential decline in precipitation that is expected with climate change.

Vegetation

Under projected future climate conditions, the proposed mechanical treatments and prescribed fire treatments under alternatives 1, 3, 4, and 5 would promote low-density stand structures, openings between groups of tree, and larger, fire-resistant trees (see the vegetation specialist report). Mechanical treatments and prescribed fire would help to mitigate the negative impacts of severe wildfire in ponderosa pine and dry mixed conifer forests by consuming (burning) less plant biomass and releasing less carbon into the atmosphere as compared to a severe wildfire (Finkeral and Evans 2008, Wiedinmyer and Hurteau 2010).

Natural reproduction of ponderosa pine would be impacted by a warmer, drier climate; it would be harder for seedlings to germinate, establish, and grow into trees. Reducing tree density would allow younger trees to survive by giving them more space to grow and thrive.

Some of the carbon contained in the tree biomass material removed by mechanical treatments would be stored for a time in wood products such as lumber, vigas, fence posts and other building materials. This is supported by Ryan et al. (2010) who found that when wood products and building material produces fewer greenhouse gas emissions during their production as compared to steel and concrete. Wood products also sequester carbon. A study of thinning treatments in ponderosa pine (Finkral and Evans 2008) found that the treatment initially produced a 30 percent reduction in the carbon stored in the standing trees. The treated stands, however, were far less likely to support a crown fire which would release even more carbon into the atmosphere.

Risks associated with dense forest conditions such as tree mortality and disease and insect outbreaks would be reduced and forest resiliency would be improved by implementing the proposed treatments. More acres are treated under alternatives 1 and 5, and so more of the forest would have increased resiliency.

Wildlife

Wildlife habitat for species requiring closed canopy forest conditions or old or large tree, snag, and log structure would be more sustainable as forest resiliency improved. Actions that reduce the probability and intensity of large uncontrolled wildfires would indirectly preserve habitat of sensitive species and the species themselves in the case of low mobility species.

The proposed action is consistent with strategies to reduce the predicted effects of climate change on cutthroat trout, by creating more resilient landscapes and addressing the issues of water quality and water quantity (Zeigler et al. 2013; Wenger et al. 2011).Changing weather conditions associated with climate change could result in shifts in bird communities as habitats may change over the landscape. Restoration projects are aimed at increasing resilience of populations to adjust to these changes.

Some areas of Jemez Mountains salamander habitat may be warmer and drier after tree density is reduced, and this may influence salamander activities and distribution. This effect could be offset by increases in snow pack, but this is still dependent on climatic conditions and climate change may reduce snow fall and exacerbate drying of habitat. Regardless, a healthy coniferous forest provides year-round shade compared to the deciduous shading of early seral shrub species that would replace the forest after high-severity wildfire.

Alternative 2

Under the projected future climate conditions, dense forest conditions resulting from the no action alternative would be at a high risk of density-related mortality. Vegetation would have limited resilience to survive and recover from potential large-scale impacts. Under drier and warmer weather conditions, the potential impacts of these risks to the ecosystem would be increased, and carbon stocks would remain high. Individual tree growth would be low to the point of stagnation. As tree density increases, many areas would have a higher tree mortality (release of carbon) than growth (carbon storage). This would result in areas becoming a carbon source to the atmosphere.

Fire-excluded forests contain higher carbon stocks. This benefit is outweighed in the long term by the loss of carbon that would likely result from a severe wildfire (Hurteau et al. 2011). Under alternative 2, most of the area would have the potential for fire effects from an uncharacteristically severe wildfire. Large-scale fire events that could occur with no treatment would release significant amounts of carbon into the atmosphere. Kolb et al. (2007) have shown that forests and carbon sequestration may fail to recover.

Larger and more frequent fires would be expected (Marlon et al. 2009). Climate may favor the spread of invasive exotic grasses into arid lands where the native vegetation is too sparse to carry a fire. When these areas burn, they typically convert to nonnative monocultures and the native vegetation is lost (USDA 2010).

Soils and watersheds are at continued risk of damage from uncharacteristically severe wildfires. This could result in increased sediment delivery to streams and the loss of soil productivity. Soils could be subject to soil erosion above tolerable levels from severe wildfires if all soils burned under condition of high-severity (see soils and water and resources specialist report). Soil productivity would not be improved on the untreated acres. Water storage in the soil is not expected to improve either.

Tree growth would be limited to the point of stagnation, and many areas would experience higher tree mortality. Wildlife species requiring closed canopy forest conditions or old or large tree, snag, and log structure would be negatively affected over the long term. Open forests and meadow and grassland habitats could potentially increase in the long term. There would be less water available to plants because of the decrease in precipitation that is predicted with climate change.

Allotment management would change as forage productivity changes (see rangeland resources report). More extreme effects, such as loss of water sources, would limit the ability of adaptive management. Higher temperatures and lower precipitation could lead to lower plant productivity and cover which, in turn, could decrease litter cover. In the past, to address drought, stocking in allotments was reduced or eliminated. With climate change, there would be longer periods without grazing. Ranchers may have to purchase supplemental feed at higher costs than grazing, and this may cause some of them to stop ranching.

The fire season would extend into the spring and fall, resulting in more forest closures due to fire danger. Forest closures would be disruptive to forest recreation users. An increase in the amount and severity of wildfires would increase the risk of damage and/or loss of developed recreation sites and dispersed recreation areas.

Conclusions about the Effects

The analysis questions are answered here:

What are the effects of project activities on climate change?

- This project is proposed on a local scale and is not intended to have cumulative effects that are measurable on a global scale in regards to climate change. The amount of greenhouse gases and carbon produced by prescribed fire treatments and other activities is very small on a global scale. The effects on global climate change from project activities cannot be calculated.

What are the effects of climate change on resources and ecosystems in the project area?

- Climate change will likely intensify the risk of ecosystem change for terrestrial and aquatic systems, affecting ecosystem structure, function, and productivity (USDA 2010).
- The primary regional level effects of climate change most likely to occur in the Southwest include: warmer temperatures, decreasing precipitation, decreased water availability with increased demand, and increased extreme disturbance events. These climate change factors could, in turn, affect ecological, weather related disturbances, and socioeconomic demands (USDA 2012).

Would the treatments increase resilience and mitigate the effects of climate change on the landscape?

- The Southwest Jemez Mountains project incorporates several of the actions included in the Southwestern Region of the Forest Service strategy to address climate change (USDA 2010). For example, proposed treatments including creating groups of trees with openings, returning fire to the landscape, and improving soils and watershed conditions. These treatments would restore and maintain resilient native ecosystems.
- Project activities would mitigate the effects of climate change when combined with other management actions regionally. Most of the project area is currently considered overstocked with trees and at risk for high-severity fires which are the greatest cause of carbon release or greenhouse gases. Alternatives 1, 3, 4, and 5 would reduce the risk of an uncharacteristically severe wildfire within the project area. These treatments would be more effective under alternatives 1 and 5 because more acres are treated with mechanical treatments and prescribed fire.

- The treatments proposed for this landscape restoration strategy are expected to move all ecosystems in this contiguous landscape toward more resilient conditions so they will have the adaptive capacity to recover from endemic insect and disease outbreaks, wildfires and climate change events. Woody byproducts will be an expected and important outcome resulting from the thinning treatments. Most importantly, the restoration treatments would restore natural fire regimes and reduce the risk of uncharacteristic wildfires to occur that would otherwise seriously damage water, soil, fish, wildlife, scenery, heritage resources, recreation opportunities, tourism, forest/timber resources, and other values in this area.

Cultural Resources and Tribal Relations

The cultural resources specialist report (Dyer and Constan 2014) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations.

Affected Environment

The Jemez Mountains are known for a great number of impressive late prehistoric archaeological sites. Prehistoric peoples have lived in and used this area for thousands of years. Most of the large prehistoric sites in the project area are the remains of pueblos (villages). Many of these villages had multi-storied buildings, were home to hundreds of individuals, and included over a thousand rooms. Thousands of small one to four-room structures known as field houses surround the large villages. Most of the known prehistoric sites in the project area date between A.D. 1250 and 1700.

There are some historic sites in the project area, dating to the late 19th and early 20th centuries. These sites are related to uses such as logging and the associated railroad construction, the Civilian Conservation Corps, and sheep and cattle grazing. These sites include cabins, corrals, logging camps, aspen trees with carved art, telephone lines, sawmills, and a mine shaft.

About 58,000 acres, or 53 percent of the project area, have been intensively surveyed for cultural resources. Almost all of the ponderosa pine vegetation type has received intensive cultural resource surveys. Many areas (about 22,000 acres) that have not been surveyed are on steep slopes (greater than 40 percent). The likelihood of finding sites on steep slopes is low. There are, however, approximately 30,000 acres that need intensive cultural resource surveys. Most of these acres are on mesa tops in the piñon-juniper woodlands, where we expect to find many more archaeological sites.

There are over 3,000 known archaeological sites in the project area, including 40 sites that are listed on the National Register of Historic Places. Based on previous surveys and site density, we think there are potentially 1,500 more sites that have not been found, for a projected total of 4,500 sites.

Low-intensity surface fires probably burned over most of these prehistoric sites in the past. Historic sites (dating primarily to the last 100 years), particularly those with wood features (cabins, corrals, aspen art), were protected from wildfire by past fire suppression polices. Now, however, these sites are likely to be severely damaged or destroyed by an uncharacteristically severe wildfire. This elevated fire hazard (high risk of fire) is due to increasing fuel loads in and around sites, drought, and climate change.

In past fuels reduction and vegetation management projects, we would "flag and avoid" sites-mark them and exclude them from treatments. Because we did not treat these sites, they are now covered with a heavy layer of fuel. These "islands of fuels" sitting on top of the sites puts them at high risk for significant damage from a wildfire, as shown in figure 27.

Figure 27. Down trees, logs, branches, and pine needles cover a prehistoric site. This site would be damaged or destroyed in a severe wildfire. (Photo courtesy of John Galvan)

Recreational use and livestock grazing have also caused damage to sites in the past. People riding ATVs sometimes drive over sites and break, move, or crush artifacts and features (walls). Sites have also been vandalized. The implementation of the travel management plan should help reduce effects on cultural resources from off-road motorized vehicle use because now trails are designated. Cattle walk over and bed down on sites. They are big animals and can damage standing walls by rubbing against them. Cattle trails running across sites can lead to erosion. Simple measures such as placing slash near walls to keep cows away and building fences or water sources away from sites have helped reduce these impacts. Our monitoring has shown that grazing at current levels is not causing adverse effects on cultural resources.

There are also over a dozen traditional cultural properties (TCPs) in the project area. These are places that are culturally significant to living communities. Examples of TCPs are shrines, trails, and rock art. Sacred sites, areas used for religious ceremonies are usually in the higher mountains and near lakes, springs, and rivers (Friedlander and Pinyan 1980). Traditional use areas, places where plants, boughs, and other resources are collected, are more widely distributed and don't usually have visible archaeological remains (Levine 1996).

Native American communities are linked to the landscape as part of their world view and spiritual being. The landscape as a whole is sacred. The Pueblo tribes have a deep connection to the Jemez Mountains. Many places still have a sense of importance and function for Pueblo communities. Access and use of these places is essential for the continuation of Pueblo life.

The Hispanic communities here also have strong ties to the land. These same lands still provide grazing land, firewood and other resources for these traditional communities.

Tribal Relations

The Santa Fe National Forest recognizes the importance of the deep connections and associations Native American groups and other traditional communities have to the project area. The forest contains ancestral lands, significant ancestral sites, sacred areas, and resource collection areas significant to Pueblo, Navajo, and Apache communities. Many of these communities are adjacent to or surrounded by national forest lands.

Treatments on and around known traditional cultural properties, sacred sites, and traditional use areas will be developed and implemented through ongoing consultation with Native American groups and other traditional communities throughout the life of this project. Information about the location and current use of these sensitive areas will be considered when prioritizing treatment areas during the implementation phase. Information from ongoing tribal consultation will be used to implement project-specific mitigation measures to protect sensitive sites.

This restoration project was included in the forestwide annual tribal consultation in the spring of 2013. Consultation packages were submitted to 36 tribal governments, their representatives, and allied government organizations with direct interest in project work conducted on the Santa Fe National Forest. These tribes included Pueblo, Apache, and Navajo groups (see appendix A in the cultural resources specialist report). Tribal members and representatives have also participated in field trips to the project area. Local tribes were invited to the public meetings and public field trips held during 2012.

Several of the surrounding tribes raised the issue of the importance of protecting Douglas-fir stands. Recent wildfires have destroyed many Douglas-fir stands in and around the project area, which makes protecting the remaining Douglas-fir stands of critical importance to the tribes that collect evergreen boughs and other forest products for ceremonial purposes.

The Pueblo of Jemez has played an integral role in the development of the proposed archaeological site treatments. They attended early partner meetings during the development of the landscape strategy. This project has been discussed at all tribal consultation meetings since 2010. We have taken Pueblo of Jemez representatives and the State Historic Preservation Office (SHPO) on field trips to the project area to show them the overall condition of the landscape, and specifically the current condition of the archaeological sites. There was strong support for the fuels and erosion reduction treatments on archaeological sites. The Pueblo and SHPO agreed that low-intensity prescribed fire would further reduce fuel loadings and promote long-term protection of these sites from unplanned ignitions.

Methods Used to Analyze the Effects on Cultural Resources

Two primary sources of information were used for this analysis: (1) the forest-level geographic information systems (GIS) layers and (2) the existing project and site files at the Jemez Ranger Station and the Supervisor’s Office of the Santa Fe National Forest. Other information came from the New Mexico Cultural Resources Information System database and GIS interface. Effects on traditional cultural properties were evaluated using the process described in Section 106 of the National Historic Preservation Act.

The number of previously recorded archaeological sites was generated by overlaying the relevant GIS layer polygons that model a treatment, such as prescribed fire, and examining the intersections of those layers. For example, the boundaries of the areas where only prescribed fire would be used under alternative 1 intersects with 1,172 previously recorded archaeological sites on the cultural site layer.

Because the project will be conducted over more than one year, clearance of the proposed activities will be accomplished using a phased approach[9]. Before any work on any phase of the project can begin, the identification and protection of historic properties must be completed in compliance with the National Historic Preservation Act. The standard consultation protocol, including consultation with Native American Tribes, must also be completed. With this phased approach, a final NEPA decision on the project may be made before all surveys in the project area are completed provided that all of the requirements of the programmatic agreement (USFS et al. 2010) are met.

Analysis Questions

The analysis questions were derived from the purpose and need, found in chapter 1.

- Would the proposed activities provide for the sustainability of cultural resources and traditional practices?
- Would the proposed activities reduce erosion, site fuel loading, and impacts from roads on archaeological sites?
- What are the effects of the restoration treatments on cultural resources?

Summary of Effects

Effects from alternatives 1, 3, 4, and 5 are similar. More sites would be treated with prescribed fire and mechanical treatments under alternative 1 (table 5). Sites that are mechanically treated and then burned would receive the most benefits. These treatments would result in beneficial indirect and cumulative effects on archaeological sites by reducing fuel loads. Reducing fuels would decrease the threat of damaging high-intensity wildfires. Road treatments that correct drainage problems would reduce or eliminate erosion damage to sites. Most of the proposed activities have the potential to affect cultural resources and traditional cultural properties. The proposed mechanical and prescribed fire treatments would have most effects on archaeological sites. These effects include, but not limited to, breakage, loss, compaction, or displacement (movement) of artifacts and structural features caused by erosion, falling trees, ground disturbance, or machinery. Tree removal would make some sites more visible to the public and increase the potential for vandalism.

For traditional cultural properties, sacred sites, and traditional use areas, access to and/or disruption of the function or use of the location could occur during treatments. Examples of potential disruptions are removal of dense vegetation, which might let the public see ceremonies or other activities; project activities occurring in an area at the same time as a seasonal ritual; and changes in the character in the immediate area of a traditional use area. All of the potential effects

[9] The phased approach is defined in Appendix J [Stipulation 14] and Appendix E [Section VI: 1] of the First Amended Programmatic Agreement.

on archaeological sites and TCPs can be avoided or mitigated by following the design criteria and mitigations in appendix A and through tribal consultation.

The potential effects on archaeological sites, traditional cultural properties, and traditional use areas are not considered to be adverse because protection measures would be implemented to address concerns that arise during consultation, by appropriate scheduling of implementation activities, and by following the design criteria and project specific mitigations in appendix A.

Table 5. Number of known sites per treatment type. The most number of sites would be treated under alternative 1. Sites receiving both mechanical treatments and prescribed fire would benefit the most.

Alternative	Number of Sites That Would Receive Mechanical Treatments and Prescribed Fire	Number of Sites in Areas That Would be Treated With Prescribed Fire Only	Number of Sites in Areas That Would be Mechanically Treated Only	Number of Sites in Areas with Other Treatments*	Total Number of Sites Treated
1	1,432	1,172	0	328	2,932
2	4	580	37	1	620
3	1,353	1,241	0	338	2,932
4	0	1,162	1,432	337	2,931
5	1,416	1,172	0	328	2,916

*Other treatments include headcut treatments, wildlife habitat improvement, campsite rehabilitation, and so on.
*These totals do not include two sites that are historic roads and would not be treated for heavy fuels.

Under alternative 2, fewer sites would be treated. The area would continue to be at risk of experiencing an uncharacteristically severe wildfire. If this happened, thousands of archaeological sites as well as TCPs, sacred sites, and traditional use areas would be damaged or destroyed.

Alternative 3 has fewer archaeological sites in areas that would be treated with both prescribed fire and mechanical treatments. More sites are in areas that would be treated only with prescribed fire, which could lead to higher intensity fire occurring near those sites.

Under alternative 4, thousands of archaeological sites are within areas that would receive only prescribed fire or only mechanical treatments (see table 4). No sites would receive the benefits of both treatments. This would increase the intensity of the prescribed fires around the archaeological sites and the level of ground disturbance from mechanical treatments.

More sites are treated under alternative 5 than under alternatives 2, 3, and 4, and slightly fewer sites than alternative 1. Sixteen archaeological sites would not receive any treatments because they are in Mexican spotted owl core areas. In protected activity centers, 81 archaeological sites would receive limited fuels reduction treatments because only trees up to 9-inches diameter would be cut. Also, more ground-disturbing activities are proposed. About two miles of control lines would be built to ensure that prescribed fire remains outside of the Mexican spotted owl core areas.

Environmental Consequences

Alternative 1

Prescribed fire has the potential to damage archaeological sites. Fire-sensitive sites (those with organic materials, wooden architecture) are at the greatest risk of damage or destruction from a wildfire, even a low-intensity fire. Other sites without flammable features are less vulnerable to fire, but can be damaged when exposed to high-intensity fire. Fire effects on less vulnerable sites include, but are not limited to: cracking of architectural stones, spalling (peeling or separating of the outer layer of rock), sooting (charcoal or black residue), and/or chemical changes to cultural materials (Lissoway and Propper 1990). The potential effects from other prescribed fire activities such as constructing fireline, digging out smoldering roots and stumps, and cutting trees or snags, could damage cultural resources and would not be allowed within site boundaries.

Removing heavy fuels from the sites is the most effective way to protect non fire-sensitive sites from significant fire effects (Elliott 1999; Lentz et al. 1992; Lissoway and Propper 1990). Any type of fire (prescribed or wildfire) may burn more intensely in areas that were not mechanically treated. Trees left within the archaeological site boundary are more likely to be killed by the radiant heat of a fire. These trees could fall on top of sites and damage them or they could disturb the subsurface (below ground) deposits when their roots come out of the ground. In areas not mechanically treated before a prescribed fire, dead fuels would be removed for a distance around each site. After the prescribed fire, sites would be checked for any fire-killed trees, and these trees would be removed so they do not fall in or onto the sites.

Figure 28. Rock art before (left) and after (right) fire. After a fire, patches of the rock have peeled away from the rock. This is an example of spalling.

Burning could indirectly create a higher potential for erosion if a lot of plant cover (grasses, forbs, pine duff) is burned off of the sites (Elliott 1999). However, the proposed fuel reduction and low to moderate-intensity prescribed fires would not sterilize the soil or create hydrophobic soils. These low-intensity prescribed fires would leave some vegetation in place. The loss of plant cover is a minor and a short-term effect because vegetation would regrow across the sites within six months to two years.

Traditional cultural properties (TCPs) would be affected by the proposed activities in a similar way as just described. In addition, access to the TCPs could be limited when treatments are happening in the area. People using the TCPs might be disturbed by the activities. Use of vegetative screening and considerate scheduling of project activities would reduce impacts. The function or character of a TCP could also be affected by our activities. For example, loss of Douglas-fir stands during a prescribed fire could affect bough gathering (boughs are used in ceremonies). Consulting with the tribes before project implementation would help to identify TCPs and traditional use areas to avoid or mitigate these possible effects. Coordination with tribal governments would allow for resolution of these potential effects, and so the potential effects are not considered to be adverse.

Other Restoration Treatments

Most of the restoration treatments would disturb the ground and so might affect cultural resources: mechanical treatments, instream and riparian habitat work, stabilizing stream banks and stream road crossings, head cut treatments, wildlife habitat improvement treatments, gravel pit construction, and temporary road construction. The protective measures listed in appendix A would address the potential effects from these treatments, and so these effects are not considered to be adverse.

Ground-disturbing activities can crush, compact, move, break, or destroy artifacts and features above and below the ground, or even the entire site. These effects can range in intensity. Mechanical treatments, for instance, can disturb cultural resources when logs are dragged across the ground, skid trails are created, and logs are piled at landings. Heavy equipment used in many of the treatments can cause rutting and compaction of the soil, which increases erosion.

Information about the site may be lost as well as the characteristics that make historic properties eligible for the National Register of Historic Places. Through the design criteria and mitigation measures the effects on archaeological sites will be mitigated. Additionally, effects on traditional cultural properties, sacred sites, and traditional use areas can be mitigated by implementing protective measures to address concerns that arise during consultation.

Road Treatments

Road maintenance and road decommissioning also have the potential to affect cultural resources. These effects are similar to those for ground-disturbing activities. The protective measures listed in appendix A would address all of these potential effects, and so these effects are not considered to be adverse.

A few of the existing roads that need maintenance or decommissioning are located within or near the boundaries of known archaeological sites. The original construction of these roads likely caused the most effects on the site. If the roadbed that intersects a site is below the cultural deposits of the site, road work can be done within the existing road prism[10] because no more damage would be done. These types of road activities can actually benefit nearby sites in instances, especially when poor drainage problems are fixed. If a road is not maintained properly, sites can be damaged when the soil erodes or when soil washes out and covers a site.

Alternative 2

Under this alternative, NEPA-approved management activities would continue. These activities are listed in appendix B. Without the landscape-scale treatments, the project area would continue to be at risk of experiencing an uncharacteristically severe wildfire. If this happened, many

[10] The road prism is the area of the ground containing the road surface, cut slope, and fill slope (uphill and downhill sides of the road).

valuable archaeological sites, TCPs, sacred sites, and traditional use areas would be damaged or destroyed. This would cause loss of important historic information, sacred sites, and research potential. If the entire project area was consumed in a severe wildfire, over 2,300 known archaeological sites could be damaged. These are sites that would have been treated under the action alternatives (1, 3, and 4) and made more resilient to wildfires.

Fuels in and around archaeological sites would continue to increase. The buildup of fuels could result in more severe wildfires resulting in significant damage to sites, including spalling, (peeling or separating of outer layer of rock) of rock art panels, cracking and spalling of architectural stone, thermal (heat-related) changes in artifacts, and post-fire erosion. The loss of all vegetative cover due from a severe wildfire would make sites more visible to people. This would result in an increased risk of vandalism and artifact theft. Erosion would increase on sites without vegetative cover. Trees killed by fire would eventually become uprooted, which could result in structural damage and artifact displacement. Finally, emergency wildfire suppression and rehabilitation activities would likely affect archaeological sites. Bulldozing or hand-digging wildfire containment lines could damage archaeological sites by destroying surface features and subsurface deposits (Lissoway and Propper 1990).

Combustible (burnable) parts of archeological remains and historic structures can be partially or completely consumed (burned up) when exposed to even the lowest-intensity fire (Lissoway and Propper 1990; Elliott 1999). If exposed to high-intensity fire, noncombustible materials, such as the remains of ceramics, stone tools, masonry architecture, and glass and metal artifacts, become blackened or glazed (Elliott 1999; Deal 2012); these materials can also spall, melt, and experience irreversible physical or chemical changes to their composition (Lissoway and Propper 1990; Elliott 1999; Steffen 2005; Deal 2012).

The loss of vegetation could expose bare surfaces and accelerate erosion; this would likely damage, destroy, displace, or remove certain cultural resources. Historic structures such as railroad beds and road-related features could be flooded, buried, or structurally weakened by increased sediment loads carried in streams and intermittent drainages.

Traditional cultural properties, sacred sites, and traditional use areas would be affected by the same activities as the archaeological remains and historic structures. A high-intensity wildfire rolling across a traditional cultural property or going through a traditional use area could cause detrimental effects such as spalling of rock, blackening of objects, and increased erosion due to loss of vegetation. The plants in a natural resource collection area may be completely lost. Changes in the character of these areas could affect the ability of a traditional group to use the site.

Alternative 3

This alternative reduces the mechanical treatment area by approximately 1,900 acres as compared to alternative 1. All other treatments remain the same.

Those 1,900 acres would be treated with prescribed fire only; they would not be mechanically treated and then burned. As discussed under alternative 1, fire intensity could be higher in areas that have not been mechanically treated prior to using prescribed fire. There are 69 more sites that would be exposed to prescribed fire only as compared to alternative 1 (see table 2 in chapter 2).

The potential effects on archaeological sites and traditional cultural properties are similar to those described for alternative 1. The physical elements, such as the stones of a shrine or the plants that are collected, of traditional cultural properties and traditional use areas could be affected in the same way as the archaeological sites in areas that are not thinned before being burned. These effects would not be considered adverse when the design features and mitigation measures in appendix A are used.

Alternative 4

Under this alternative, slash from mechanical treatments would not be burned. It would be treated in some other way and there would be more intensive ground disturbance from offsite removal of material, chipping, shredding, mastication, or other slash treatment method used. This alternative potentially could have a greater effect on cultural resources than alternative 1. There are 1,432 archaeological sites that could be affected in the areas that are mechanically treated but not burned.

Woody debris would increase in the areas that are mechanically treated only. The fuels from the mechanical treatments could increase the intensity of a wildfire. As described for alternatives 1 and 3, dead trees could fall within or on top of archaeological sites or traditional cultural properties after a wildfire. Effects on traditional cultural properties and traditional use areas are also similar to those in alternatives 1 and 3. The potential effects can be addressed using the same measures described for alternative 1, and so the effects are not considered to be adverse.

Alternative 5

Under this alternative, no human activities would occur in Mexican spotted owl core areas and only trees up to 9-inches diameter would be cut in Mexican spotted owl protected activity centers. About 700 fewer acres would not be treated with prescribed fire as compared to alternative 1.

Sixteen archaeological sites within the core areas would not any treatments of any kind and would be at risk for damage or destruction in the event of a wildfire. The physical elements of traditional cultural properties and traditional use areas within Mexican spotted owl core areas could be affected in the same way as archaeological sites within the core areas. Restoration treatments conducted on the surrounding landscape would indirectly help to protect archaeological sites and traditional cultural properties within the core areas.

An additional 81 sites are within the Mexican spotted owl protected activity centers that would receive minimal fuels reduction treatments (only trees up to 9-inches diameter would be cut). This is not ideal as there may be instances in which a larger-diameter tree that poses a threat to an archaeological site (e.g. a tree leaning toward a structure) would not be cut. However, if all dead and downed logs and small-diameter trees are removed from these 81 sites, these protective actions should be enough to minimize impacts to cultural resources in the event of a fire over the short term. These sites would need to be monitored closely after either a wildfire or prescribed fire to determine whether any fire-killed trees need to be cut and removed. Snags that pose a threat to cultural resources (e.g. that may fall over on top of a structure or cause damage to subsurface deposits due to tree root pull) would be identified for removal avoid any adverse effects on archaeological sites.

About two miles of fire control lines (hand-built) would be needed to keep prescribed fire out of the core areas, resulting in additional ground disturbance. This has the potential to affect historic properties. Use of the project-specific mitigation measures for all ground-disturbing activities (appendix A) and the site avoidance strategies and site protection measures listed in appendix J of the Region 3 Programmatic Agreement, the potential effects are not considered to be adverse.

Forest Plan Amendments, Alternatives 1, 3, 4, and 5

None of the proposed forest plan amendments are likely to adversely affect cultural resources. Several amendments would help to achieve the objective of cultural resource protection, including 1) those related to allowing treatments in Mexican spotted owl habitat; 2) eliminating activity restrictions during wildlife breeding seasons; and 3) allowing for interspaces.

The proposed amendments that allow vegetation treatments in Mexican spotted owl habitat would be beneficial to cultural resources. The 97 known archaeological sites within the 6 PACs (3,113 acres of the total project area) could be treated to reduce fuels within archaeological site boundaries. Without the amendments, only trees up to 9-inches diameter could be cut within protected activity centers, thereby restricting fuel reduction treatments on 81 archaeological sites. If no human activity were allowed within core areas around nest sites, no fuels reduction treatments would take place on an additional 16 sites.

The amendments to eliminate activity restrictions during wildlife breeding seasons also have the potential to benefit cultural resources. By lifting the timing restrictions there would be more flexibility in scheduling fuels reduction activities, allowing for the treatments in and around archaeological sites to be expedited. Fewer acres would be treated in a timely manner if the breeding seasons must be avoided.

The amendment clarifying language to allow for interspaces would result in more openness across the landscape, which would benefit archaeological sites and traditional cultural properties by reducing the risk of crown fires throughout the project area. The other proposed amendments related to replacing plan language about site plans with surveys around falcon zones and amendments related to scenery, would have no effects on cultural resources.

Cumulative Effects

Past and current activities that are affecting archaeological sites and traditional cultural properties in this area and their effects are summarized in the affected environment above. When considering past, present, and foreseeable future actions (appendix B) all of the action alternatives have the potential to increase the amount of ground-disturbing activities and prescribed fire across the landscape. All of these undertakings that have the potential to affect cultural resources and TCPs would be analyzed as required under Section 106 of the National Historic Preservation Act. Mitigation measures have been or would be implemented to keep ground-disturbing activities out of archaeological site boundaries. Fuels reduction treatments have been or would be implemented to minimize fire effects on archaeological sites and traditional cultural properties during prescribed fires. Because of this, the potential cumulative effects on cultural resources and TCPs are not considered to be adverse.

Increasing the scale of restoration treatments instead of conducting small “postage stamp” restoration projects, would reduce fuels at the landscape scale. Reducing fuels would provide long-term protection for the entire landscape and all of the archaeological sites and traditional cultural properties within it, from disturbances such as wildfire. The travel management plan and motorized vehicle use map should also help reduce effects on cultural resources and TCPs that would otherwise happen from off-road vehicle use and creation of new routes. Cumulatively, all of the various forest management projects in and adjacent to the project area would measurably improve long-term protection of cultural resources and TCPs. They would have a low potential for adverse effects on archaeological sites and TCPs in the project area.

Conclusions About the Effects

The analysis questions are answered here to see how the alternatives meet the purpose and need.

Would the proposed activities provide for the sustainability of cultural resources and traditional practices?

- The restoration treatments would help protect archaeological sites, traditional cultural properties, sacred sites, and traditional use areas for future generations.
- Alternative 1 would provide the most sustainability and protection for these areas because more of the areas are treated with a combination of prescribed fire and mechanical treatments. Alternatives 3, 4, and 5 would provide less sustainability. Areas that are only treated with prescribed fire could burn with a higher intensity, resulting in more damage to cultural properties. Areas that are only treated with mechanical treatments would have more ground disturbance and could burn with a higher intensity during a wildfire, which would have more effects on cultural resources.
- Under alternative 2, cultural resources and traditional practices would not be sustainable because the area would be vulnerable to an uncharacteristically severe wildfire. If this happened, many valuable traditional cultural properties, sacred sites, and traditional use areas would be damaged or destroyed. Important historical information, sacred sites, and research potential would be lost.

Would the proposed activities reduce erosion, fuel, and impacts from roads on archaeological sites?

- The proposed activities would reduce the amount of fuel on sites and reduce erosion and impacts from roads. Sites in areas that receive both mechanical treatments and prescribed fire would benefit the most. For all action alternatives (1, 3, 4, and 5) potentially adverse effects on sites would be avoided with use of the measures in appendix A.
- Alternative 1 would treat the most sites and would be the best for cultural resources. Most of the 2,932 archaeological sites are in areas that would have mechanical treatments and prescribed fire (see table 4). These sites would benefit from having both types of treatment occurring in the surrounding area. None of the sites would be mechanically treated only.
- Alternative 2 would not meet the purpose and need. Only 620 archaeological sites would be treated for fuel reduction. Most sites are in areas where only prescribed fire would be used. These sites are more likely to experience a higher intensity prescribed fire because the areas were not thinned prior to burning. Thousands of archaeological sites that would have been treated under the other alternatives would be vulnerable to severe damage should a wildfire occur in the area. This damage would result in great loss of information and research potential.
- Alternative 3 is good for cultural resources, but fewer archaeological sites would have the benefits of the combination of prescribed fire and mechanical treatments. Sites treated with prescribed fire only would likely experience a higher intensity fire effects.

- Alternative 4 is much less desirable for cultural resource protection. Thousands of archaeological sites would only receive prescribed fire or only mechanical treatments. No sites would receive the benefits from the combination of treatments. There would be more ground disturbance in areas that are mechanically treated only. Prescribed fires would likely be of higher intensity.
- Alternative 5 is not as desirable for cultural resources as alternative 1.Under alternative 5, 16 sites in Mexican spotted owl core areas would not be treated and 81 sites in protected activity centers would receive a limited fuels reduction treatment. Construction of fire control lines would result in more ground disturbance.

What are the effects of the restoration treatments on cultural resources?

- Almost all of the proposed activities have the potential to affect cultural resources and traditional cultural properties. The primary effects on archaeological sites from other project activities are due to ground disturbance and burning. These potential effects can be addressed by site avoidance strategies, site protection measures, and project-specific mitigation measures (see appendix A). Therefore, the potential effects are not considered to be adverse.
- Effects on traditional cultural properties fall into three categories: direct physical effects on the physical properties of TCPs, limitation on access to TCPs by traditional practitioners, and disruption of use or function of TCPs. To mitigate or avoid these effects, consultation with surrounding tribal groups will be conducted so that we can identify locations of TCPs and avoid physical effects on these areas. Discussion with tribal officials can help with implementing project activities so that access to TCPs is not impeded and to provide protection from disruption of the traditional uses or functions of property.
- Restoration treatments would help protect archaeological sites, traditional cultural properties, sacred sites, and traditional use areas for future generations. The combination of prescribed fire and mechanical treatments would provide the most protection. Areas that are only treated with prescribed fire could burn with a higher intensity and cultural properties might receive more damage. There would be more ground disturbance in areas that only receive mechanical treatments. Construction of fire control lines under alternative 5 would also result in more ground disturbance. These areas could also burn with a higher intensity during a wildfire, which would have more effects on cultural resources. Discussions with tribal officials can help reduce problems with access to TCPs, sacred sites, and traditional use areas and provide protection from disruption of traditional uses or functions of a property.

Fuels

The fuels specialist report (Carabajal and Armstrong 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations. The Landscape Assessment (USFS 2010) also has detailed information about fuels, fire behavior, and fire history in the Southwest Jemez Mountains and is incorporated by reference.

Affected Environment

Fuel is more than the dead, down, and standing woody debris, it also includes living vegetation-leaves, grasses, trees, and shrubs. Ladder fuels are the smaller trees, shrubs, and low branches that can carry a surface fire "from the ground to the crown". When the fire reaches the tree canopy, it can spread quickly and is nearly impossible to control. These crown fires are very destructive and are what you usually see in news stories about wildfires. We can prevent crown fires by removing ladder fuels and reducing canopy density and breaking up the contiguous interlocking crowns.

A fire regime is the pattern of the frequency, intensity (how hot it burns), and severity (how much is damaged) of wildfires. It describes how a fire would have acted without modern human interference (Agee 1993). Fire regimes can gives an idea of which tree species were more common, whether larger or smaller trees might have survived or been killed by fires, or whether trees were killed at all. We can compare today's wildfires to the historical fire regime and see if they are similar (Arno and Allison-Bunnell 2002). The departure, or gap, between historical and current fire regimes helps us manage fuels and forests.

We can measure changes in fire regimes using fire regime condition class (FRCC). Fire regime condition class represents the current ecological trend in forest structure, composition, and processes. The condition classes describe the degree of departure from historical conditions:

- FRCC 1- no or low departure
- FRCC 2- moderate departure
- FRCC 3- high departure

Changes in FRCC happen because of changes in vegetation (species composition, structural stages, stand age, canopy closure); the type of fuels; and other disturbances (insect and disease mortality, grazing, and drought).

Here are some other terms used in this section:

- Active crown fire: This type of fire moves into the tree crown, and advances from crown to crown in the tops of trees or shrubs (NWCG 2008). Active crown fires result in high severity burns and are considered "stand replacing" because they burn most of the vegetation.
- Fire hazard: This is the chance that a wildfire may start and cause damage. It is driven by the frequency of lightning strikes and human ignition, neither of which is affected by fuel treatments.
- Fire type: A description of fire behavior and the role of fire in an ecosystem. This analysis refers to surface fire, active crown fire, and passive crown fire types.
- Fuel hazard: This is the volume, quantity and location of fuels. It does not include the influence of weather and topography.
- Ladder fuels: Ladder fuels, are the smaller trees, shrubs and low branches that have the potential to carry a surface fire up into the tree crowns (Figure 29). When ladder fuels catch on fire, the flames can reach the lower limbs of the overstory trees and initiate a crown fire.

- Passive crown fire: This is surface fire with enough energy to preheat and combust and burn fuels above the surface (Agee 2002). The fire climbs up ladder fuels into the crowns of individual trees or groups of trees but does not continue to spread into adjacent crowns. (figure 29)
- Surface fire: These fires burn debris on rangeland and forest floor surfaces including dead branches, leaves, and low vegetation dry enough to be fuel. The intensity (hotness) of the fire and the rate of spread (how fast it grows) are affected by the size, arrangement, amount, type, and moisture level of the surface fuels along with weather and topography.

Figure 29. Ladder fuels in San Diego Canyon (left). The small trees and shrubs underneath the larger trees can move fire from the surface into the crowns of the trees. Passive crown fire, or torching, during a fire on the Pecos-Las Vegas Ranger District (right). The fire has burned into the crown of the tree in the center of the photo, but has not spread to nearby trees.

Fuel and Fire Regimes in the Southwest Jemez Mountains

Wildfire in southwestern forests is inevitable and is the primary disturbance of southwest ponderosa pine forests, an essential regulating process of forest health (Edmonds et al. 2000). There is no substitute for fire in these ecosystems. Fire reduces and/or maintains fuel loads, low tree densities and the open, park-like stands typical of these forests. Fire also recycles nutrients and rejuvenates the understory grasses and forbs.

Without fire the objectives of ecological restoration and fuel reduction in southwestern forests cannot be met. In these dry forests, woody debris accumulates rapidly, but decomposes slowly. Fire is the only tool that reduces surface fuels and maintains them at safe levels. When the fire cycle is broken, these forests become susceptible to large, uncharacteristically severe wildfires. In the Southwest Jemez Mountains, the fire cycle is broken as seen in the character of the Cerro Grande and Las Conchas fires.

There has been a lot of research about natural forest conditions and fire regimes in ponderosa pine forests in the Jemez Mountains (Allen 1989, 2001; Touchan et al. 1995, 1996; Allen et al. 1995; Touchan and Swetnam 1995; Swetnam and Baisan 1996). Open forests with groups of trees and a grassy understory are the key features for the forest. Historically the fire regime was low-intensity, high frequency surface fires. These historic fires burned grasses, brush, and small trees, but left the large and old trees standing. They burned every few years and kept fuel loads at a low level.

In the project area, the surface fuel load ranges from 14 to 55 tons of woody debris per acre. This is considered a heavy load and will promote a high-intensity fire (Sackett 1979). This is higher than the levels needed for ecological benefits. In dry, warm forests of the northwest 5-10 tons/acre of woody debris is recommended for ponderosa pine and Douglas-fir forests (Brown et al. 2003). This is very similar to the 5-13 tons/acre recommended for Rocky Mountain ponderosa pine (Graham et al. 1994).

Ponderosa pine makes up the largest part of the forest, but we're also concerned about dry mixed conifer. The fire regime in dry mixed conifer is similar to ponderosa pine, but the time period between fires is longer and the fires in dry mixed conifer forest type burned a little hotter. Much of the dry mixed conifer is also FRCC 3. All of the other forest types in the area are in FRCC 2 or 3. Meadows and riparian areas are in FRCC 1 or 2.

Right now, about 60 percent of the project area is currently in FRCC 3, meaning that forest conditions have departed substantially from historic conditions. The gap is due to the increase in fuels and changes in forest structure because of past fire suppression, logging, and livestock grazing. These changes are described in detail in the Landscape Assessment (USFS 2010).

Wildfires in this area have shown the results of these changes in fuel and forest conditions. There have been 13 large (over 300 acres) fires in the Jemez Mountains in the last 20 years. Most of them have exhibited crown fire behavior. Some of these recent wildfires- Dome (1996), Cerro Grande, and Las Conchas, were unlike the wildfires that burned in the area before the late 1800s. They burn through the tree crowns consuming (burning up) the leaves or foliage and killing the overstory trees. Crown fires generate enormous flame lengths and are difficult to suppress. These uncharacteristic crown fires covering large areas are historical aberrations. They are a result of past land use patterns and institutional decisions that tried to remove wildfire from the forests and left them choked with trees, laden with fuel, and susceptible to uncharacteristic and destructive fires.

Other Factors that Affect Fuels and Fires

Wildfire risk is high. The Southwest U.S., including the Jemez Mountains, has a lot of lightning (Reap 1986), most of it occurring during July and August, the monsoon season. Most of the lightning ignited fires are accompanied by rain and usually don't get very large. Use and development in the area from recreation, hunting, roads, powerlines, and communities has led to human-ignited fires. Our recent large fires have occurred during the spring when hot dry winds can make fires spread rapidly. The current long-term drought is also affecting fuel and fire conditions like those observed during the Las Conchas fire. The topography of the area-mountains intersected by canyons- makes fire suppression operations difficult and can result in a larger burned area if a fire becomes established.

Methods Used to Analyze Effects of Fuels and Fire

The main purpose of a fuel treatment is to alter the behavior of a wildfire entering the treated area making it more controllable and reducing the impact (severity) of that wildfire. Fire severity is reduced by reducing surface fuels, increasing the height to the live crown, reducing crown density, and retaining large trees of fire-resistant species. In this section, we use fireline intensity and change in fire type (defined below) to explain the effects that the mechanical treatments and prescribed fire would have on a wildfire.

- Fire type- Wildland fires can be classified into two different types, surface fires and crown fires. Crown fires are often divided into two different types, passive and active.
- Fireline intensity- This is the rate of heat release per unit length of fireline, usually expressed in BTUs per foot per second (BTU/ft/sec) (SAF 2008). When the fireline intensity is below 500 BTU/ft/s, direct attack fire suppression tactics[11] can be used. At this intensity, flame lengths are typically less than 4 feet.

We used the Forest Vegetation Simulator (FVS) (Dixon 2002) with the Fire and Fuels Extension (FFE) (Reinhardt and Crookston 2003) to model the effects of the mechanical treatments and the initial entry prescribed fire for each alternative. FlamMap (Finney 2006) was used to model potential fire behavior and fireline intensity for the project area. This showed the stand-level fire behavior changes resulting from the proposed treatments by alternative.

Details about these modeling programs and the assumptions and limitations used are found in the fuels specialist report. The purpose of our modeling analysis was not to predict the behavior of a real fire, but to compare the potential effects between treatment alternatives. Alternative 2 was used as the baseline. Comparing the effects also lets us see how well each alternative meets the purpose and need. The modeling assumed that there was only one cycle of prescribed fire. Maintenance burns were not modeled.

Analysis Questions

The analysis questions were derived from the purpose and need and the issues that arose during scoping as described in chapter 1. The relevant analysis questions are:

- Would the mechanical treatments and use of prescribed fire reduce the potential for uncharacteristically severe wildfires and promote frequent, low-intensity surface fires?
- What are the effects of prescribed fire on the environment?

Other concerns about the use of prescribed fire came up during scoping: the need for prescribed fire; the potential of an escaped prescribed fire; and the number of acres proposed for restoration and fuels treatments. These concerns were addressed in the scoping report, which is in the project record.

Summary of Effects

Alternatives 1, 3, and 5 had similar effects. All three reduced fire hazard on approximately 30,000 acres. The potential fire type changed from active or passive crown fire to surface fire. Fireline intensity was similar for these alternatives. On over 80 percent of the area, a wildfire would burn at less than 500 BTU/ft/s. Wildfires burning at less than 500 BTU/ft/s also have lower flame lengths (less than 4 feet) and are typically more manageable and safer to control.

[11] Direct attack on a fire means that firefighters build a fireline right along the edge or perimeter of a fire. This is usually done on low-intensity fires. Indirect attack means building a fireline some distance away from the edge of the fire. The unburned fuel between the fireline and the fire is backfired or burned out. This is usually used on high-intensity fires (very hot fires) that are spreading very quickly. In these situations, direct attack is not safe.

Alternative 2 was used as the baseline for comparison. Without treatments, half of the area would remain at risk for a crown fire. More of the area would burn at intensities greater than 500 BTU/ft/s, as compared to alternatives 1, 3, and 5, making wildfires more difficult to manage.

Under alternative 4, there are fewer acres in the surface fire type than alternatives 1, 3, or 5. The number of acres that would experience the passive crown fire type increases by about the same amount. Fireline intensities are higher over most of the area than under the other action alternatives because there is more fuel (slash) on the site. About 90 percent of the treatment area would burn at intensities greater 500 BTU/ft/s. Under alternative 1, about 17 percent of the area is above the 500 BTU/ft/s threshold.

Environmental Consequences

Alternative 1

The proposed mechanical treatments and use of prescribed fire would reduce fire hazard on about 31,000 acres. There was an improvement in fire type and fireline intensity as compared to alternative 2 (no action).

The reduction in fire hazard means that conditions have improved on about 31,000 acres, or 29.1 percent of the treated acres. The fire type changed from active crown fire to surface fire on these acres. This is shown in figure 30 and table 6 below.

Table 6. Change in fire type after mechanical treatments and prescribed fire. After treatments, fire hazard would be reduced. More acres would experience surface fire.

	Fire Type	Alternative 1	Alternative 2*
Fire Type by Acres**	Surface Fire	83,562 acres	52,751 acres
	Passive Crown Fire	16,950 acres	35,081 acres
	Active Crown Fire	5,226 acres	17,996 acres
	Acres Improved	30,901 acres	NA
Fire Type by Percent	Surface Fire	79%	49.9%
	Passive Crown Fire	16%	33.1%
	Active Crown Fire	5%	17%
	Acres Improved	29.1%	NA

*Alternative 2 is the baseline. Changes in fire type resulting from mechanical treatments and prescribed fire are compared to alternative 2.
**Acres used in the fire modeling do not match the acres of mechanical treatments. Information about stand structure was missing for some areas and could not be modeled.

Table 7 shows the changes in fire type in ponderosa pine and dry mixed conifer forests, where most of the treatments would take place. After treatments, more acres of each forest type would move from the crown fire categories into the surface fire category.

Table 7. Change in fire type in ponderosa pine and dry mixed conifer forests. Without treatments, 14 percent of ponderosa pine acres would experience active crown fire. After treatments, only 2 percent of ponderosa pine acres would experience active crown fire. Dry mixed conifer showed similar improvements.

Forest Type*	Fire Type	Alternative 1	Alternative 2
Ponderosa Pine 43,527 acres	Surface Fire	91%	52%
	Passive Crown	8%	34%
	Active Crown	2%	14%
Dry Mixed Conifer 21,900 acres	Surface Fire	79%	28%
	Passive Crown	16%	42%
	Active Crown	5%	30%

Changes in fire type for other forest types are in the fuels specialist report.

Fireline intensity also improved (table 8) with the treatments. After treatments, the fireline intensity on most of the area is below 500 BTU/ft/s. Before treatments, about 60,000 acres were below this threshold. After treatments, over 90,000 acres were below the threshold, a 50percent increase in acres below the 500 BTU/ft/s threshold.

Table 8. Fireline intensity after mechanical treatments and prescribed fire. After treatment fireline intensity is below 500 BTU/ft/s on most acres. It is safer for fire crews to use direct suppression tactic on fires when fireline intensity is below 500 BTU/ft/s.

Fireline Intensity in BTU/ft/s*	Alternative 1	Alternative 2
0 - 100	34,798 acres	37,853 acres
101 - 500	55,856 acres	22,613 acres
501 -1,000	3,298 acres	3,693 acres
1,001 - 2,000	3,253 acres	5,788 acres
2,001 - 4,000	4,596 acres	11,524 acres
4,001 - 5,500	7,537 acres	27,840 acres

*BTU per foot per second

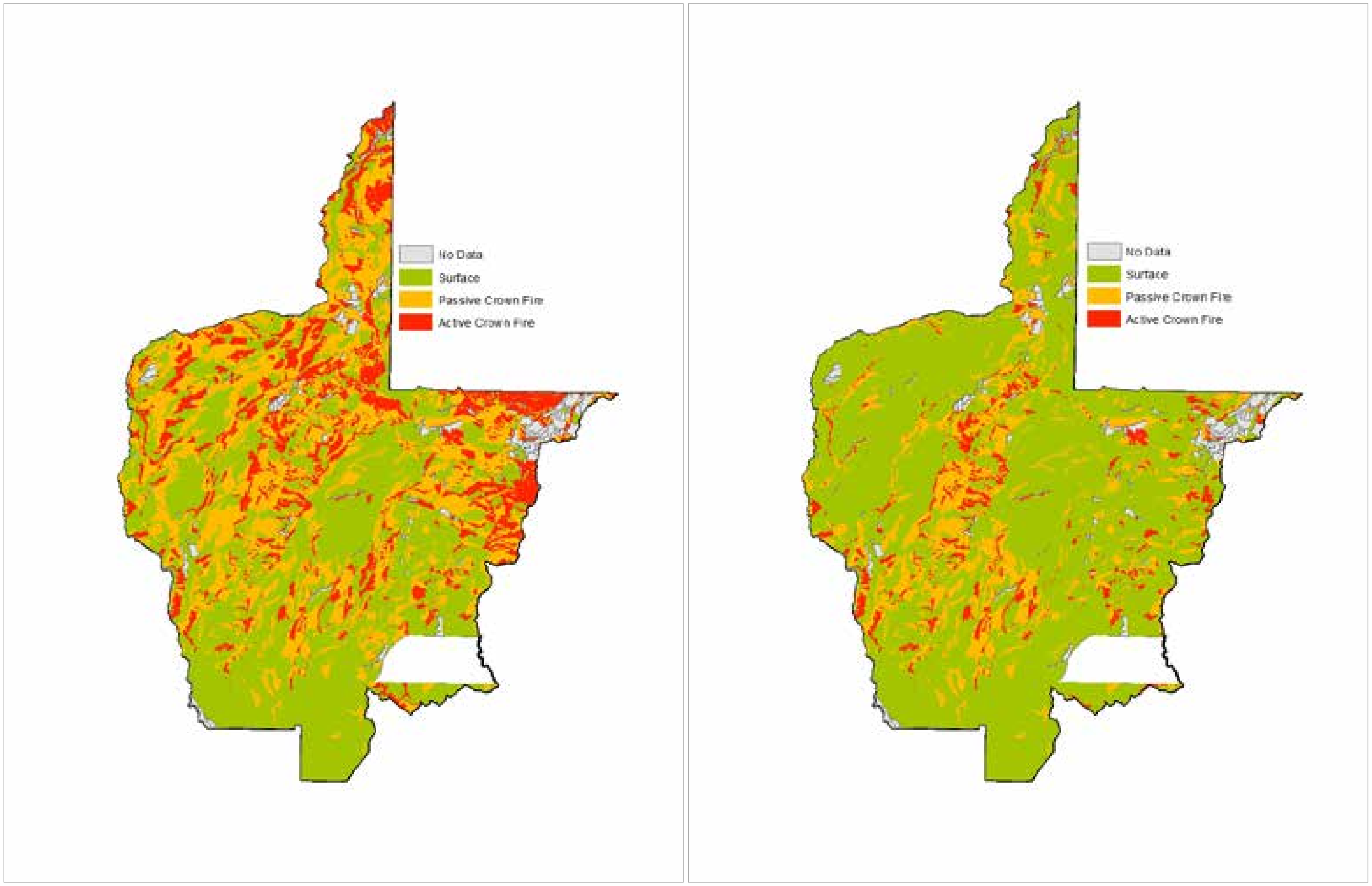

Figure 30. Fire types after treatments under alternative 1 (right) and alternative 2 (left). The change in fire type from active or passive crown fire to surface fire is dramatic. Nearly 31,000 acres (29 percent of the treated acres) were improved from active or passive crown fire to surface fire after mechanical treatments and prescribed fire.

Alternative 2

Without management action, much of the project area would remain at risk for crown fire because forest conditions would continue to decline. The departure or gap from the historic fire regime would increase. As seen in table 6 above, the modeling results show that crown fire potential is high. Nearly half of the landscape would experience crown fire.

Alternative 3

The changes in fire type and fireline intensity under alternative 3 are similar to alternative 1 (tables 9-11). The changes in fire type under alternative 3 are virtually the same as compared to alternative 1, so there is no figure for this alternative. About 1,900 fewer acres would be mechanically treated under this alternative. These 1,900 acres would still be treated with prescribed fire, but there would be less slash because they are not mechanically treated. This small change in mechanically treated acres accounts for the subtle changes in fire type and fire intensities for this alternative.

Table 9. Change in fire type after mechanical treatments and prescribed fire under alternative 3. After treatments, fire hazard would be reduced. More acres would experience surface fire.

	Fire Type	Alternative 3	Alternative 2*
Fire Type by Acres	Surface Fire	82,359 acres	52,751 acres
	Passive Crown Fire	16,281 acres	35,081 acres
	Active Crown Fire	7,188 acres	17,996 acres
	Acres Improved	29,608 acres	NA
Fire Type as Percent of Area	Surface Fire	77.8%	49.8%
	Passive Crown Fire	15.4%	33.4%
	Active Crown Fire	6.8%	16.8%
	Percent of Acres Improved	28%	NA

When looking at changes in fire type in ponderosa pine and mixed conifer (table 10), again, the results are similar to alternative 1, especially in ponderosa pine. In dry mixed conifer, about 3 percent more acres are in the active crown fire type than under alternative 1.

Table 10. Change in fire type in ponderosa pine and dry mixed conifer forests. There is a slight increase in active crown fire in dry mixed conifer as compared to alternative 1. Other changes in fire type are similar to alternative 1.

Forest Type*	Fire Type	Alternative 3	Alternative 2
Ponderosa Pine 43,527 acres	Surface Fire	89%	52%
	Passive Crown	8%	34%
	Active Crown	3%	14%
Dry Mixed Conifer 21,900 acres	Surface Fire	76%	28%
	Passive Crown	16%	42%
	Active Crown	8%	30%

Finally, fireline intensities mirror those of alternative 1 (see table 8).

Table 11. Fireline Intensity after mechanical treatments and prescribed fire under alternative 3. After treatment fireline intensity is below 500/BTUft/s on most acres. These results are very similar to alternative 1.

Fireline Intensity in BTU/ft/s	Alternative 3	Alternative 2
0 - 100	34,892 acres	37,853 acres
101 - 500	55,272 acres	22,613 acres
501 -1,000	3,376 acres	3,693 acres
1,001 - 2,000	3,311 acres	5,788 acres
2,001 - 4,000	4,536 acres	11,524 acres
4,001 - 5,500	7,925 acres	27,840 acres

Alternative 4

Alternative 4 would reduce the acres treated by prescribed fire by approximately 41percent. There are some differences in types of fire and fireline intensity under this alternative. Fireline intensities are higher over most of the area than under the other action alternatives.

There would be about 7,700 fewer acres in the surface fire type than alternative 1 and 6,400 fewer acres in the surface fire than alternative 3 (table 12 and figure 31). The number of acres that would experience the passive crown fire type increases by about the same amount. There is less surface fire under alternative 4 because the slash is not treated by prescribed fire. The untreated slash can increase the intensity and flame length of a wildfire, and the potential for a passive crown fire is higher (Agee 2005).

Mechanical treatments would reduce the ability of a fire to move from tree crown to tree crown (active crown fire). They also reduce torching (passive crown fire) in some areas by removing smaller trees that act as ladder fuels. When prescribed fire is not used after thinning, however, the surface fuel load leads to hotter fires and torching is more likely to happen. If the slash is piled up high enough, it can act as a ladder fuel and increase the likelihood of torching.

Table 12. Change in fire type after mechanical treatments and prescribed fire. After treatments, fire hazard would be reduced. More acres would experience surface fire.

	Fire Type	Alternative 4	Alternative 2*
Fire Type by Acres	Surface Fire	75,962 acres	52,751 acres
	Passive Crown Fire	24,577 acres	35,081 acres
	Active Crown Fire	5,289 acres	17,996 acres
	Acres Improved	23,211 acres	NA
Fire Type as Percent of Area	Surface Fire	71.8%	49.8%
	Passive Crown Fire	23.2%	33.4%
	Active Crown Fire	5%	16.8%
	Percent of Acres Improved	21.9%	NA

Ponderosa pine and dry mixed conifer cover types show no change in active crown fire potential between alternatives 1 and 4 (table 13). However, there is more potential for passive crown fire and less for surface fire in both vegetation types than alternative 1. This is due to the lack of prescribed fire after mechanical treatments, as explained above.

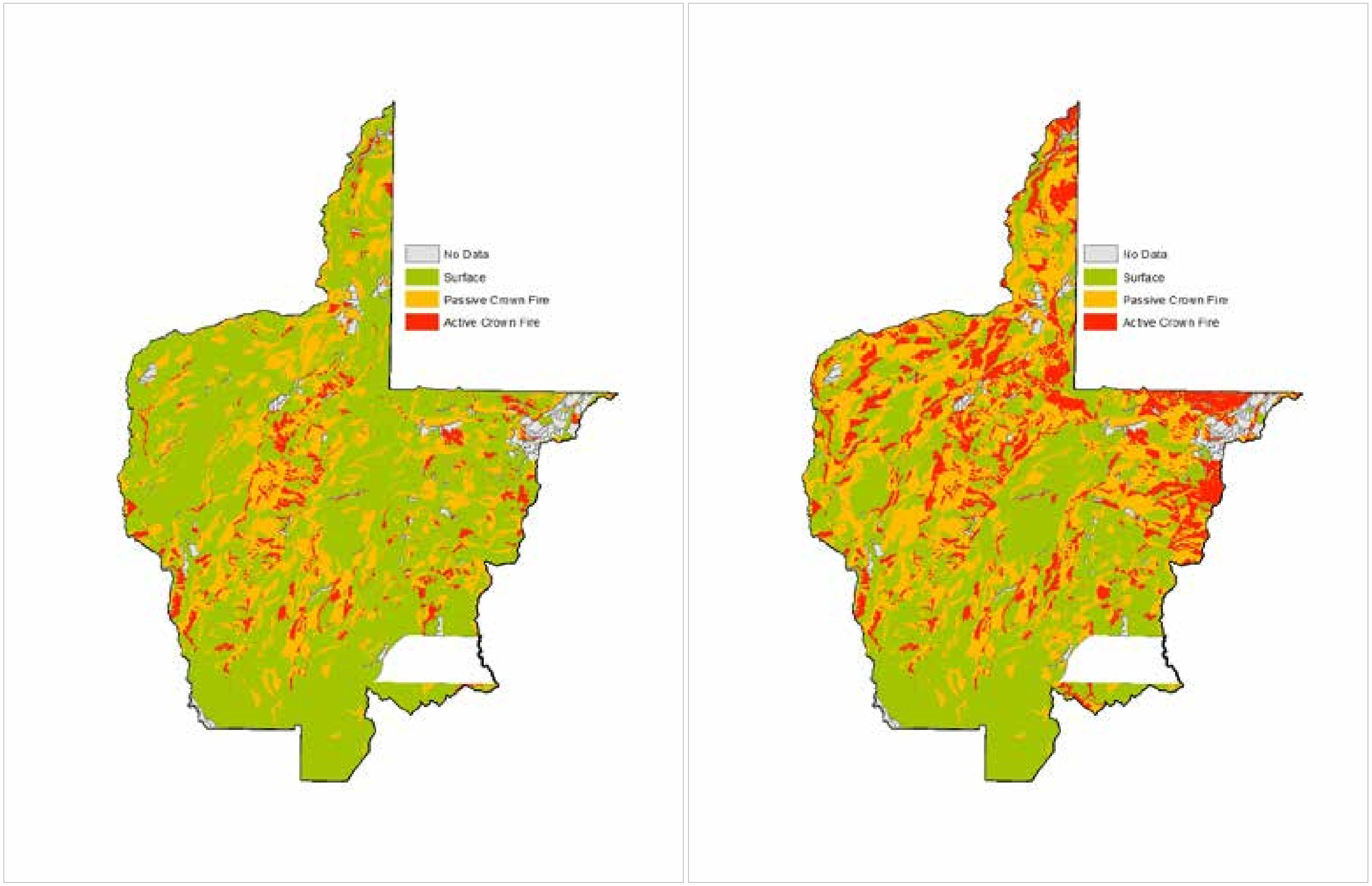

Figure 31. Fire types after treatments under alternative 4 (left) and alternative 2 (right). About 7,500 more acres would burn as passive crown fire than alternative 1. This is because fewer acres are treated with prescribed fire under this alternative. Most of these areas of passive crown fire are found on the east side of the project area. Smaller areas are on the west side, in the mesas area.

Table 13. Change in fire type in ponderosa pine and dry mixed conifer forests. Without treatments, 14 percent of ponderosa pine acres would experience active crown fire. After treatments, only 2 percent of ponderosa pine acres would experience active crown fire. Dry mixed conifer forests showed similar improvements.

Forest Type*	Fire Type	Alternative 4	Alternative 2
Ponderosa Pine 44,827 acres	Surface Fire	79%	52%
	Passive Crown	19%	34%
	Active Crown	2%	14%
Dry Mixed Conifer 22,835 acres	Surface Fire	70%	28%
	Passive Crown	25%	42%
	Active Crown	5%	30%

Table 14. Fireline Intensity after mechanical treatments and prescribed fire. After treatment fireline intensity is below 500/BTU/ft/s on most acres. It is safer for fire crews to use direct suppression tactic on fires when fireline intensity is below 500/BTU/ft/s.

Fireline Intensity in BTU/ft/s	Alternative 4	Alternative 2
0 - 100	4,456 acres	37,853 acres
101 - 500	6,640 acres	22,613 acres
501 -1,000	40,932 acres	3,693 acres
1,001 - 2,000	44,294 acres	5,788 acres
2,001 - 4,000	5,000 acres	11,524 acres
4,001 - 5,500	7,989 acres	27,840 acres

Fireline intensity is higher because the slash is not treated with prescribed fire. In the modeling exercise, the slash becomes surface fuel and is burned under extreme wildfire conditions, not the more controlled conditions found when prescribed fire is used.

A wildfire burning with the intensity shown in table 9 would be more difficult to control. Indirect attack methods, such as bulldozers, helicopters, and air tankers would be used instead of direct methods. The fire would be larger and would likely cause more damage to forests and communities, and would cost more to put out.

Research on the effectiveness of treating fuels shows that only combinations of treatments that reduced both canopy and surface fuels had significant treatment effectiveness when modeled under extreme weather conditions (Omi et al. 2006). Mechanical treatments followed by prescribed fire are an example of a combination treatment. Mechanical treatments reduce canopy fuels and prescribed fire reduces surface fuels.

Alternative 5

Alternative 5 would reduce the acres treated by prescribed fire by about 700 acres, or less than 1 percent. More restricted habitat would be mechanically treated as compared to alternative 1, but there is a 9-inch diameter cap on trees cut in Mexican spotted owl habitat.

The changes in fire type and fireline intensity under alternative 5 are similar to alternatives 1 and 3. The changes in fire type under alternative 1 are virtually the same for this alternative, so there is no figure for this alternative. The small change in the prescription for mechanical treatments in

Mexican spotted owl habitat and the lack of any human activity within core areas explains the minimal difference for the changes in fire type and fire intensities for this alternative.

Table 15. Change in fire type after mechanical treatments and prescribed fire. After treatments, fire hazard would be reduced. More acres would experience surface fire.

	Fire Type	Alternative 5	Alternative 2*
Fire Type by Acres	Surface Fire	83,723 acres	52,751 acres
	Passive Crown Fire	16,806 acres	35,081 acres
	Active Crown Fire	5,299 acres	17,996 acres
	Acres Improved	30,972 acres	NA
Fire Type as Percent of Area	Surface Fire	79.1%	49.8%
	Passive Crown Fire	15.9%	33.4%
	Active Crown Fire	5%	16.8%
	Percent of Acres Improved	29.3%	NA

Ponderosa pine and dry mixed conifer cover types show no change in surface, passive crown, or active crown fire potential as compared to alternative 1 (table 16).

Table 16. Change in fire type in ponderosa pine and dry mixed conifer forests. Without treatments, 14 percent of ponderosa pine acres would experience active crown fire. After treatments, only 2 percent of ponderosa pine acres would experience active crown fire. Dry mixed conifer forests showed similar improvements.

Forest Type*	Fire Type	Alternative 5	Alternative 2
Ponderosa Pine 43,527 acres	Surface Fire	91%	52%
	Passive Crown	8%	34%
	Active Crown	2%	14%
Dry Mixed Conifer 21,900 acres	Surface Fire	79%	28%
	Passive Crown	15%	42%
	Active Crown	6%	30%

Fireline intensities mirror those of alternative 1 (see table 8).

Table 17. Fireline Intensity after mechanical treatments and prescribed fire. After treatment fireline intensity is below 500/BTU/ft/s on most acres. It is safer for fire crews to use direct suppression tactic on fires when fireline intensity is below 500/BTU/ft/s.

Fireline Intensity in BTU/ft/s	Alternative 5	Alternative 2
0 - 100	34,704 acres	37,853 acres
101 - 500	55,721 acres	22,613 acres
501 -1,000	3,590 acres	3,693 acres
1,001 - 2,000	3,208 acres	5,788 acres
2,001 - 4,000	4,569 acres	11,524 acres
4,001 - 5,500	7,520 acres	27,840 acres

Forest Plan Amendments

Forest plan amendments related to Mexican spotted owl protected activity centers would allow more flexibility in conducting vegetation and prescribed fire treatments in these areas including the core habitat. The effects would be beneficial and would reduce the potential for a high-severity wildfire under alternatives 1, 3, and 4 as compared to alternative 5.

Amendments allowing treatment during breeding seasons would have positive effects on fuels management and prescribed fire activities by increasing the treatment window. The amendment clarifying the language regarding interspaces would also have beneficial effects on fuels management. The risk of a high-severity wildfire would also be reduced.

The amendments regarding peregrine falcon site plans and scenery management would have no effects on fuels management activities.

Cumulative Effects

The cumulative effects take into consideration both planned and unplanned activities that have occurred in area within the last 20 years, along with any proposed projects (see appendix B). Planned activities include prescribed fire and mechanical treatments that have an effect on limiting the potential for uncharacteristically severe wildfire. Unplanned activities include wildfires managed under a full suppression strategy, a confine/contain strategy, and/or a resource benefit strategy. All cumulative effects in this section will be described in terms of their effectiveness at reducing crown fire potential.

In the past 20 years, much of the Jemez Mountains have been affected by wildfire. These wildfires ranged from low-severity fire to high-severity, stand replacement fires. All of them have had an impact on current fire behavior and the forest's vulnerability to future uncharacteristically severe wildfires. For example the Las Conchas fire of 2011 burned during the peak of fire season and burned about 150,000 acres. The fire burned just over 700 acres within the project area. Much of this area was severely burned and will not sustain a crown fire for many years to come.

Other wildfires in the area burned under less severe fire weather conditions than the Las Conchas fire of 2011 and were represented more by mixed and low severity effects. The South Fork fire (2010) burned approximately 15,000 acres. Common effects of this and similar fires are the consumption of ground and surface fuels, reduction of ladder fuels, raising of the canopy base height and mortality of smaller isolated pockets of trees caused by burning. All of these effects contribute to a reduced potential of a future uncharacteristically severe wildfire.

Past and current prescribed fire projects and mechanical treatments have been conducted all within and near the project area. These treatments can reduce crown fire potential within a treatment area. Landscape-scale and/or multiple fuels treatments are needed to disrupt the spread of large wildfires because they can easily burn around or spot over small, individual treatment blocks. The accumulation of treatments across the landscape reduces the opportunity for wildfire to move into the tree crowns by reducing ladder fuels and excess surface fuel loads. Although the risk of wildfire may remain constant, the fuels hazard is reduced. Overlapping treatment areas have similar outcomes to that of wildfires that burned under low to mixed severity conditions. There are several proposed projects on the Coyote, Cuba, and Española Ranger Districts that would also contribute to fuels objectives.

Cumulative effects would be minor. Past wildfires, prescribed fires, and mechanical treatments are distributed across the landscape. These areas are undergoing constant change as both live and dead fuels continue to accumulate. The past actions and proposed actions of the adjoining area would not contribute to any significant impacts.

Conclusions about the Effects

What are the effects of prescribed fire on the environment?

- Prescribed fire would affect many aspects of the environment: air quality, forest structure and composition, understory vegetation, and soils and watersheds. These effects are discussed in the air quality and wildlife, fish, and rare plants, range, soils, and vegetation sections of chapter 3.
- Other important effects of prescribed fire are its effects on fuels and fire behavior. Prescribed fire reduces live and dead fuel. Landscape-scale fuel modifications, such as prescribed fire, are the most effective way to change the behavior and growth of large fires (Finney 2001). Stands with prior fuel treatments experience lower wildfire severity than untreated stands burning under the same conditions (Omi and Martinson 2002, Strom and Fulé 2007).

Would the mechanical treatments and use of prescribed fire reduce the potential for uncharacteristically severe wildfires and promote frequent, low-intensity surface fires?

- Prescribed fire used in combination with mechanical treatments would reduce fire hazard in the treatment area. Future wildfires would burn at a lower intensity and won't spread or grow as quickly (Graham et al. 2004). More of the area would be likely to experience a surface fire instead of an active or passive crown fire. Lower fire intensities and surface fires are closer to the natural fire regime of the fire-adapted forests here. A single prescribed fire, however, would not reestablish low fuel hazard conditions. Any trees killed by prescribed fire would add to the fuel loading over time (Keifer et.al 2006).
- The ponderosa pine and dry mixed conifer forests in this area are fire-adapted forests. Fire plays a key role in these forests and is necessary for their maintenance and continuity. Prescribed fire can provide the ecological effects of natural fires. Prescribed fire can be an effective tool for restoring forests and reducing surface and ladder fuels. Moderate intensity prescribed fire can restore the structural diversity in mixed conifer forests that was lost because fires were suppressed for many years (Keifer et al. 2000). Low to moderate-intensity prescribed fire alone won't reduce the dense stands of trees. Mechanical treatments are also needed to move the forest toward its natural state, especially in forests with mature, fire-resistant trees.

Nonnative and Invasive Plants

The nonnative and invasive plants specialist report (Gallegos 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations.

Affected Environment

Nonnative and invasive plants (also known as noxious weeds) are aggressive species that displace (push out or replace) native plant species. They often grow in areas where the soil has been disturbed and exposed, such as along roads and trails, in dispersed campsites, and areas where livestock gather. They are spread by wind, rain, floods, animals, vehicles, water, and people.

Nonnative and invasive plants can turn native plant communities into monocultures and disrupt natural ecological processes. They also reduce the abundance and diversity of native wildlife species and microorganisms in those ecosystems. Wildlife habitat is affected by nonnative and invasive species. They replace more nutritious and tasty native forage plants and do not provide good places to nest or hide. Some species are poisonous. Nonnative and invasive plants can also lead to economic losses. The loss of wildlife habitat and livestock reduces hunting success rates and rancher income.

There are about 2,300 acres of inventoried invasive plant infestations scattered throughout national forest system lands within the project area. It is difficult to determine exactly how many acres of each separate species are out there. This is because many species grow in the same area, creating mixed infestations. The most common invasive plant species in the project area are tamarisk, Russian olive and Siberian elm. These plants are found along the Jemez River and other low elevation streams. Concentrations of other invasive plants are usually seen in riparian areas, wildfire scars, and along roads.

The New Mexico Department of Agriculture (NMDA) currently lists 37 weed species on its noxious weeds list (NMDA 2009). Table 14 lists of the nonnative and invasive species currently inventoried and mapped within the project area. It also shows the classification, the dominate vegetation type where it's found, and approximate acreage of the infestations.

Table 18. Nonnative and invasive plant species found in the project area, its NMDA classification, associated vegetation type, and acres of infestation. The most acres of infestations are in riparian areas, meadows, and sensitive areas.

Name of Nonnative and Invasive Plant	NMDA Class	Vegetation Type	Acres of Infestation within Vegetation Type
Bull Thistle	C- species are distributed throughout the State	Riparian Areas, Meadows, and Sensitive Areas	2,100 acres
Canada Thistle	A- species are not present or have very limited distribution in New Mexico	Riparian Areas, Meadows, and Sensitive Areas	
Field Bindweed	C- species are distributed throughout the State	Riparian Areas, Meadows, and Sensitive Areas	
Nodding Thistle (Plumeless or Musk Thistle)	B- species are widespread in the State	Riparian Areas, Meadows, and Sensitive Areas	
Poison Hemlock (Spotted Hemlock)	B- species are widespread in the State	Riparian Areas, Meadows, and Sensitive Areas	
Russian Olive	C- species are distributed throughout the State	Riparian Areas, Meadows, and Sensitive Areas	
Saltcedar (Tamarisk)	C- species are distributed throughout the State	Riparian Areas, Meadows, and Sensitive Areas	

Name of Nonnative and Invasive Plant	NMDA Class	Vegetation Type	Acres of Infestation within Vegetation Type
Siberian Elm (Chinese Elm)	C- species are distributed throughout the State	Riparian Areas, Meadows, and Sensitive Areas	
White Top (Hoary Cress)	A- species are not present or have very limited distribution in New Mexico	Riparian Areas, Meadows, and Sensitive Areas	
Nodding Thistle (Plumeless or Musk Thistle)	B- species are widespread in the State	Ponderosa Pine	195 acres
Scotch Thistle	A- species are not present or have very limited distribution in New Mexico	Ponderosa Pine	
Russian Knapweed (Hardheads)	B- species are widespread in the State	Ponderosa Pine	
Nodding Thistle (Plumless or Musk thistle)	B- species are widespread in the State	Mixed Conifer	20 acres

Other nonnative species, such as common mullein, have been found in the project area. Although mullein is not currently listed on the NMDA noxious weeds list, its ecological effects are just as damaging as those species that are listed.

We have not done many surveys for invasive plants, and we believe that there are considerably more infestations and species that we have not found and mapped yet. Efforts to find these new or unknown infestations would continue throughout the life of this project. We will treat nonnative and invasive species found within the project area regardless of their listing status.

A forestwide environmental impact statement that evaluates weed control treatments is in progress. The use of chemicals (herbicides) to treat invasive nonnative plant infestations identified within the project area will be delayed until the completion of the invasive plant control (weeds) EIS. Until then, we would use other non-chemical treatment methods, such as hand grubbing. Proposed activities would create an environment that is vulnerable to new infestations and the expansion of existing ones. Timely detection and effective treatment methods are vital to controlling and containing existing, new, and expanding infestations.

Methods Used to Analyze Effects

The methodology used to analyze the extent and status of infestations and effects on nonnative and invasive species within this area is largely based on Geographic Information Systems (GIS) technology, and personal knowledge of the area. Data sets were used from the U.S. Forest Service GIS Corporate Data (2012) and the Forest Service Activity Tracking System (FACTS). The FACTS database is used to track infestations and treatments. Field personnel used GPS to map infestations. The location was entered into the GIS database. The species name, size of the infestation, and type of treatment (if treated) were recorded in FACTS.

Analysis Questions

The analysis questions were derived from the purpose and need and the issues that arose during scoping as described in chapter 1. The relevant analysis questions are:

- What effect would the proposed activities, including the treatments for nonnative and invasive species, have on the establishment, spread, and control of nonnative and invasive plant species?
- How would the proposed treatments of nonnative and invasive plant species limit or control their spread?

Summary of Effects

Alternative 1 would provide the best response to the threat of nonnative and invasive species because some control methods- hand grubbing, prescribed grazing, and prescribed fire- would be implemented. These control methods, along with the mitigation measures and monitoring, would reduce and control infestations of nonnative and invasive plants. Alternative 1 would also provide the largest increase in herbaceous native vegetation, which directly compete with nonnative and invasive species. The mechanical treatments and use of prescribed fire would reduce the risk of a severe wildfire and potential post-fire infestations.

Alternatives 3, 4, and 5 would have similar benefits as alternative 1, but on fewer acres. Areas that are not treated would be more susceptible to severe wildfires and other disturbances that may help the spread of nonnative and invasive plant species. Alternative 3 would have the best short-term effect on preventing the spread of nonnative and invasive plants because temporary roads would not be built.

Alternative 2 would have the least benefit to ecosystem resilience as only small, fragmented projects would be carried out. The inventory, monitoring and treatment of infestations would not be done. Ecosystem conditions would continue to decline and there would be an elevated risk for an uncharacteristically severe wildfire. These conditions would allow existing infestations to spread and new ones to become established.

Environmental Consequences

Alternative 1

All of the proposed activities would cause some level of soil disturbance. The amount and duration of soil disturbance influences the severity of the infestation. The road treatments- road maintenance, road decommissioning, and construction of temporary roads- pose a larger threat because they cause more soil disturbance and remove more vegetation than other activities.

Road Work

The more developed a road[12] is, the more likely there will be an infestation of nonnative species near the road and in the forest (Gelbard and Belnap 2003). These roads have higher levels of soil disturbance from vehicle traffic and maintenance activities. Roads are good habitat for invasive plants. Roads typically have less tree cover and so get more sunlight. Water runs off the road and

[12] Developed roads have a better surface and are easier to drive on. A gravel road is more developed than a dirt road, and a paved road is more developed than a gravel road.

increases soil moisture next to the road. These create good conditions for the spread of invasive plants.

Building temporary roads and skid trails and the development of gravel pits would cause the most soil disturbance and bare ground. That makes these areas vulnerable to the establishment of nonnative and invasive species. Not only that, these areas would also have a lot of vehicle traffic, which would help spread invasive plants around that particular site and carry seeds to other areas.

Road decommissioning activities may or may not cause the establishment and spread of nonnative and invasive species as vehicles and machinery enter the site to remove the roads from the landscape. The length of a decommissioning project and the extent of the work being done (seeding alone, ripping and seeding, building earthen barriers or water bars) will largely affect the vulnerability of a site to infestations. Over time, the risk of establishment and spread may be reduced once work is completed as vehicles will no longer enter these areas. Road maintenance activities would also disturb the soil and have the potential to provide seedbeds or serve as a pathway for the introduction and spread of invasive plants.

Prescribed Fire

The low-intensity broadcast burns proposed for ponderosa pine forests are not expected to contribute to the spread of nonnative and invasive plants. The research on prescribed fire and the spread of invasive plants is mixed, but generally, low-intensity burns in ponderosa pine do not disturb the soil very much and this limits the establishment and spread of plants (Fowler et al 2008). Other factors besides soil disturbance contribute to the spread of these plants. Keely (2006) noted that regardless of the size of the burn, the amount of nonnative and invasive species already present on the landscape was the largest factor influencing whether or not burned areas would become infested.

Burn preparation activities such as fireline construction would disturb the soil and create bare ground. Burning slash piles may also contribute to the spread and establishment of invasive plants. The heat generated by burning slash piles remains localized and can cause severely burned soils. This destroys the seedbank of native vegetation and alters the soil chemistry. The soils may become hydrophobic- the water rolls off instead of being absorbed (Ballard 2000). The heat generated by burning slash piles remains localized and can severely burn the soil. This destroys the native vegetation seedbank and alters the soil chemistry. Pile burning is usually done from fall to early spring when temperatures are cooler. This reduces the amount of heat on the soil.

Other Activities that May Contribute to the Spread and Establishment of Nonnative and Invasive Plants

The other restoration treatments have the potential to disturb the soil and create bare ground: instream habitat work, development of water sources for wildlife, screening water sources, enhancing seeps and springs, headcut treatments, enhancing riparian vegetation and restoration of dispersed campsites. These activities include the use of hand tools, heavy machinery, and vehicles.

Measures to control and contain infestations of nonnative and invasive species are included in the proposed action. Methods used include hand pulling of weeds, prescribed grazing, and prescribed fire. These proposed treatments, in combination with the existing monitoring program would allow managers to better prevent new infestations and prevent their spread, and treat current infestations.

Design criteria and mitigation measures have been developed to reduce the spread or establishment of nonnative and invasive species from all activities (appendix A). The key to achieving this is surveying areas prior to treatment to identify, and where appropriate, treat infestations.

Alternative 2

The effects displayed under alternative 1 would not occur because the proposed activities would not be carried out. Current management would continue as is, and projects that have completed NEPA planning would be implemented. Without treatment, nonnative and invasive plant species would continue to expand. Infestations would not be treated; we would only inventory and/or monitor new and existing infestations until the EIS for the invasive plant control project is completed. Treatments occurring outside of the project boundary would continue. However, as much of the Jemez District is included under the proposed action for this project, a large portion of the district would not receive treatment. As a result, current infestations would continue to spread and new infestations will become established and grow.

Figure 32. Thistle infestation after the Las Conchas wildfire. The fire created large areas of bare soil that allowed invasive plants to establish and spread.

Alternative 3

The effects under this alternative would be the same as alternative 1, but on fewer acres. Under this alternative, about 1,900 acres would not be mechanically treated because no temporary roads would be built to these areas. These acres would be treated with prescribed fire only. Roadways are the main way that nonnative species are spread (Von der Lippe and Korwik 2007). Under this alternative the risk of new infestations would be reduced. However, these areas would remain at risk for uncharacteristically severe wildfire and other disturbances that could lead to larger infestations.

Alternative 4

The effects are similar to those of alternative 1, except for the areas that are mechanically treated. In mechanically treated areas, slash would not be burned; it would be treated by some other method. Native vegetation would not respond as quickly without the use of prescribed fire, giving invasive plants an advantage. The amount of fuel on the ground would increase. In the event of an uncharacteristically severe wildfire, the soil may be damaged by the intense heat and create large areas of bare soil. This increases the likelihood of new infestations and the spread of existing ones.

Alternative 5

The effects are similar to those of alternative 1. In Mexican spotted owl habitat, mechanical treatments would be of lower intensity, and there would be about 700 fewer acres of prescribed fire. The potential of the spread or establishment of invasive plant infestations would be slightly reduced because there would be slightly less ground disturbance due to the lower intensity of the treatments. However, these untreated areas would still remain at risk for uncharacteristic wildfire as well as insect and disease outbreaks.

Forest Plan Amendments

The proposed amendment changes would not have an effect on the spread or establishment of nonnative plant populations. Prescribed fires and mechanical treatment would still occur; they are the primary mechanism for the spread or establishment of nonnative plant populations.

Cumulative Effects

The area considered for cumulative effects is the entire project area. Nonnative and invasive plants are easily established and have the potential to spread rapidly without treatment. So, all ground-disturbing activities would create conditions that encourage the establishment and spread of these plants.

Activities on the Valles Caldera National Preserve, Jemez Pueblo lands, private, state, county, and other federal or other tribal lands adjacent to the project boundary are expected to continue. Management actions on those lands could also help nonnative and invasive species to establish and spread. However, these landowners may also treat infestations with herbicide or other control methods, which would contribute to the reduction of infestations across the landscape.

Conclusions about the Effects

The analysis questions are answered here.

What effect would the proposed activities have on the establishment and spread of nonnative and invasive plant species?

- All of the alternatives have ground-disturbing activities from increased vehicle use that could potentially contribute to the spread of nonnative and invasive plant species. The proposed design features and mitigation measures would minimize the spread of invasive plants. The implementation plan would also minimize the effects of the proposed activities on the spread of invasive plants and the appropriate response to infested areas. Alternative 2, no action, does not include any preventive or control measures, and populations of invasive plants would continue to increase.

How would the proposed treatments of nonnative and invasive plant species limit or control their spread?

- The current condition would be expected to improve. Treatments to control the establishment and spread of nonnative and invasive plants would maintain or enhance native plant communities and other natural resources on the forests. Mechanical treatments would allow understory vegetation to establish and grow. This native vegetation would directly compete with the nonnative and invasive plants. The implementation plan would also minimize the effects of the proposed activities on the spread of invasive plants and the appropriate response to infested areas.

Rangeland Resources

The rangeland resources specialist report (Gallegos 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations. The social science, economics and environmental justice specialist report discusses the economic impacts related to livestock grazing use.

Affected Environment

Livestock grazing is important to the local economy and is directly tied to the history and strongly rooted culture that has shaped the present day area. There are several small predominantly Hispanic villages in the area. The residents retain their traditional values and depend on the use of natural resources, including livestock grazing and the use of forest products. Raising livestock contributes to a sense of identity, prestige within the community, pride of lifestyle, and a feeling of self-sufficiency. These create a strong sense of community (Raish and McSweeny 2003; 2012).

Livestock grazing contributes to the livelihood of permittees and the economy of local communities and counties. For most permittees, livestock grazing is generally not a commercial venture. Most of the permittees have other jobs and do not make their sole living from livestock production, although for some, a substantial portion of their income is derived from livestock. The permittees typically own small ranches, and federal grazing permits are integral to their overall operations.

The project area contains all or part of nine grazing allotments: Bear Springs, Cebolla/San Antonio, Del Norte, Las Conchas, Peralta, Ponderosa, San Diego, Vallecitos, and V-Double Slash (table 19). The 13 permits cover 24 individual livestock operations. The Jemez National Recreation Area is not part of an active grazing allotment and so is not analyzed. In the project are there are 87 miles of fence, 14 corrals, 65 earthen (dirt) tanks, 29 spring developments, 3 wells, 31 miles of pipeline, 7 storage tanks, 32 drinkers and 43 cattleguards.

Adaptive management is used to adjust current resource conditions with livestock numbers. The number of authorized livestock, season of use, and levels of livestock use can vary from year to year based on resource conditions.

Table 19. Grazing allotments and acreage within the project area

Allotment Name	Total Acreage of Allotment	Acres of Allotment in Project Area	Number of Permits**	Number of Permitted Livestock
Bear Springs*	2,301	67	NA	NA
Cebolla/San Antonio	26,171	7,164	4	347
Del Norte	7,890	176	2	67
Las Conchas	1,396	1,396	1	27
Peralta	12,882	1,178	1	53

Allotment Name	Total Acreage of Allotment	Acres of Allotment in Project Area	Number of Permits**	Number of Permitted Livestock
Ponderosa	2,816	2,561	1	28
San Diego	102,738	54,741	1	250 and 14 bulls (December –April) 117 and 14 bulls (May-November)
Vallecitos	16,254	16,254	1	107 5 bulls
V-Double Slash	37,408	22,548	2	181 6 bulls
Totals	209,856	106,085	13**	--

*The Bear Springs allotment is vacant. About 90 percent of the allotment was given to the Santo Domingo Pueblo in a land transfer, and the associated permit was also waived to the pueblo.
**The 13 permits represent 24 individual livestock operations.

Methods Used to Analyze Impacts on Rangeland Resources

The methods used to analyze the capacity and effects on rangelands within this area is largely based on Geographic Information Systems (GIS) technology, the Terrestrial Ecosystem Survey (TEUI) of the Santa Fe National Forest and personal knowledge of the area. Data sets were used from the U.S. Forest Service GIS Corporate Data (SNF 2012a). The silviculture, fire, and soil and water resources specialists' reports were also used in the analysis. Private and Pueblo lands were not analyzed.

Analysis Questions

We received a few comments about rangeland and grazing management during the public involvement efforts. Some were outside the scope of this project. Please see the scoping report for the responses to these comments. This analysis will address the following questions:

- What effect would the proposed activities have on herbaceous vegetation?
  This is the response of native herbaceous vegetation[13] to the proposed activities.
- What effect would the proposed activities have on grazing and allotment management?
  This is the effect the proposed activities would have on the ability to continue grazing within the project area. It also looks at the effects of the proposed activities on the management of the entire allotment as a whole because most allotments are not entirely within the project boundary.
- How would the proposed activities affect the permittees?
  This is the potential economic effect on the permittees.

[13] Herbaceous vegetation is non-woody plants eaten by cows, elk, and other grazing animals.

- How would impacts on grazing be minimized?

Summary of Effects

Under alternative 1, range condition is expected to improve as forage production and quality increases, utilization rates decrease, and distribution of livestock improves. The long-term benefits would outweigh the short-term effects and would ultimately improve the ecological sustainability of livestock grazing, and substantially increase ecosystem resilience to uncharacteristically severe wildfire and other disturbances. There would be a temporary reduction in authorized livestock numbers, reduced seasons of use, or a combination of both so that prescribed fire could be used. Effects would be short term and would not result in permanent changes to permitted livestock numbers or season of use. These effects would only occur in order to facilitate the use of prescribed fire.

Alternatives 3, 4, and 5 would have the same benefits as alternative 1 but on a smaller scale because fewer acres are treated with prescribed fire and mechanical treatments. Under alternative 4, the herbaceous vegetation would not respond as quickly after a prescribed fire.

Alternative 2 would have the least benefit to rangeland resources and ecosystem resilience because only small-scale, fragmented projects would be implemented across the landscape. Herbaceous vegetation and available livestock forage would continue to decline in areas that are not treated. There would continue to be periodic reductions in authorized livestock numbers or season of use, or a combination of both due to localized treatments.

It will be difficult to minimize the short-term effects on the livestock permittees that would occur from using prescribed fire. Vacant, unused, or other grazing opportunities are not currently available to permittees who may need alternate grazing areas after allotments are treated with prescribed fire.

Proposed treatments within the Bear Springs, Del Norte, and Peralta allotments are not expected to have a large effect on the management of the entire allotment. Only a small part of each allotment, about one pasture, is within the project boundary. Also, the Bear Springs Allotment is currently vacant, so activities are not expected to affect an individual permittee. There would be minimal effects on the Ponderosa Allotment also, because it is grazed only during winter months when plants are dormant. Access to this allotment is very limited, which would restrict the amount of treatments being implemented.

Environmental Consequences

Alternative 1

Under this alternative the number of permitted animal unit months (AUMs) would stay the same. This alternative would largely affect the Cebolla/San Antonio, Las Conchas, San Diego, Vallecitos, and the V-Double Slash Allotments.

Effects of Prescribed Fire

We expect an increase in range capability and improved range conditions after using prescribed fire. This means that more of the allotment can be used by grazing animals under proper management without long-term damage to the soil resource or plant communities. Right now, cows cannot get to some areas because of the dense stands of timber. Other areas have limited amounts of forage, again, because there are too many trees. Prescribed fire would thin the dense stands of trees and remove fuels. This would allow livestock to use areas that were inaccessible before burning.

Prescribed fire would increase the amount of herbaceous vegetation within the ponderosa pine and dry mixed conifer forest types. There would also be an increase in species diversity, abundance, and distribution of herbaceous vegetation (Covington et al. 1997; Webster and Halpern 2010). Similar effects on herbaceous vegetation are likely to occur in other forest types, including aspen (USDA 1989) and piñon-juniper (Covington et al. 1991). The seeds of some plants stay dormant in the soil until the hard seed coat is softened or broken (scarified). Fire scarifies these seeds so they can germinate.

The use of prescribed fire would result in adverse short-term effects (1-3 years) on livestock grazing, allotment management, and individual permittees. After a prescribed fire is complete, there is a rest period of 1-2 years. This rest period is needed to let the soil stabilize and for grasses and forbs to reestablish themselves and grow. Perennial grasses[14] that lose their leaves, as through grazing, in the first growing season after a fire produce less forage and don't grow as well. They are also more likely to die (Jirik and Bunting 1994; Bunting et al 1998).

Permittees may be required to temporarily reduce their authorized livestock numbers, shorten the season of use, or do a combination of both to allow herbaceous vegetation to recover and regenerate during the 1-2 year rest period. These permittees would be economically impacted. These impacts are described in the socioeconomic section of this chapter. Design features and mitigation measures (see appendix A) would be used to help permittees to the extent possible before and after using prescribed fire. The timing and location of the restoration treatments would be done to minimize impacts on the permittees.

The short-term impacts on grazing and permittees discussed above would be reduced with maintenance or re-entry burning. Livestock can be moved around an allotment to take advantage of the improved forage while another part of the allotment is undergoing a maintenance burn. Reentry burns would also burn with less intensity because the amount of fuel would be greatly reduced during the initial burn, thus allowing for more flexibility in adaptive management.

Prescribed fire could potentially have greater effects on an allotment if there is a drought in the year before the burn. The drought would slow reestablishment of native herbaceous vegetation. In this scenario, reductions of authorized livestock numbers, season of use, or a combination of both could compound the effects on livestock grazing, allotment management, and the permittees in order to align livestock grazing numbers with resource conditions.

The long-term benefit of increased forage production would outweigh the short-term impacts from using prescribed fire. The increase in forage production from these treatments would improve allotment conditions and allow for a more flexible grazing management scheme because livestock distribution would improve and livestock utilization rates would decrease. Range capability is also expected to increase. These benefits would allow for a sustainable range program through drought years, and for low-intensity surface fires to occur on the landscape, further sustaining forage production.

[14] Grasses that produce flowers and seeds year after year.

Mechanical Treatments and Stand Improvement Thinning

Reducing tree density with mechanical treatments would increase the diversity and abundance of understory plants- grasses, forbs and shrubs. Removing trees opens up the canopy and allows more light and precipitation to reach the forest floor, and reduces competition between plants for soil moisture and nutrients. These conditions improve growing conditions for understory plants in dry forest types including piñon-juniper (Bates et al. 2000; Brockway et al., 2002), ponderosa pine (Covington et al. 1997; Griffis et al. 2001), and mixed conifer (Collins et al. 2007). The combination of mechanical treatments followed by prescribed fire often has an additive effect- the increase in understory vegetation is greater after the two treatments than either one by itself (Griffis et al. 2001; Laughlin 2008).

The wet mixed conifer and piñon-juniper vegetation types would receive little or no prescribed fire, but would be mechanically treated. These areas would also have an increase in range capability and forage production. Mechanical treatments would be done at different intensities- more trees would be removed in some areas than in others- to achieve specific management objectives. Because of this, the increase in herbaceous vegetation would vary across the treated areas. It may also take longer to occur in areas that are treated less intensely (fewer trees are removed). Impacts of increased vegetation are discussed above under prescribed fire.

Mechanical treatments would increase range capability- livestock could use areas that were previously inaccessible or had limited forage availability- and with similar effects. Mechanical treatments, with or without prescribed fire, would also reduce fuel loads and lower the potential for an uncharacteristically severe wildfire that could cause significant damage to rangeland resources.

Mechanical treatments and stand improvement thinning would have some minor short-term impacts (1-3 years) on livestock grazing, grazing management, and the permittees. These include the loss of available forage or use of pastures and damage to range infrastructure (fences, water tanks, etc.). These impacts would result from the activity of harvesting equipment, vehicle traffic, use of skid trails, and construction of landings (staging areas).

Mechanical treatments have been implemented in the general area in the past with few impacts on livestock grazing, allotment management, and permittees. For this project, mitigation measures and design features are expected to reduce impacts on livestock grazing before and during these treatments (see appendix A). Even so, it may be necessary in some instances to limit or delay grazing in areas where treatments are actively occurring.

The long-term effects of mechanical treatments outweigh the undesirable short-term effects. It is expected that over a 10-year period, the increase in forage production from these treatments would improve allotment conditions and livestock distribution, decrease utilization rates and allow for a more flexible grazing management scheme. These benefits would allow for a sustainable range program through drought years, and for low-intensity ground fires to occur on the landscape.

Meadow Treatments

The extent of conifer encroachment or invasion into mountain meadows is clearly seen in figure 1, which compares aerial photos from 1935 and 2009. Over the last 75 years, meadows throughout the Southwest have shrunk (Moore and Huffman 2004). Meadows provide important habitat for wildlife, add to biological diversity, and are pleasing to look at. A meadow opening has four to five times the herbaceous production and plant richness of the forest understory (Moore and Huffman 2004). These grasses and other plants are lost as trees invade and meadows shrink. Forage capacity and availability is then also reduced.

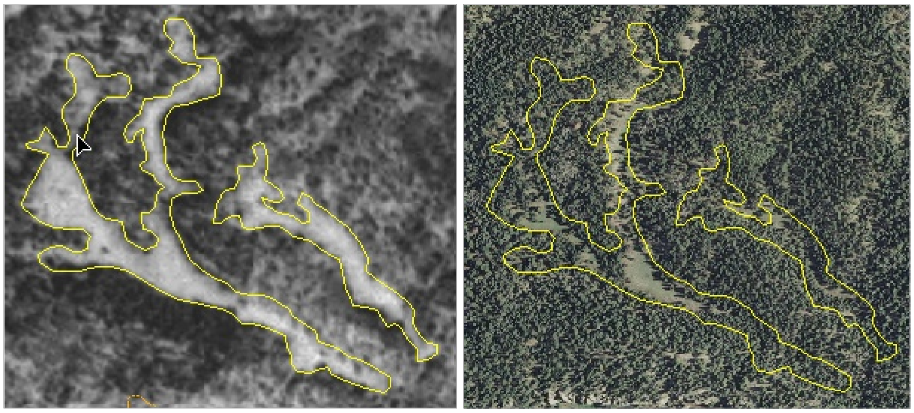

Figure 33. Tree invasion of two large meadows in the Las Conchas grazing allotment. The photo on the left was taken in 1935; the one on the right was taken in 2009. The meadow is outlined in yellow. The smaller meadow on the right is almost completely filled with trees. The large meadow on the left is over half filled with trees. Lack of fire and a warmer climate have let trees slowly take over the meadows in these mountains (Coop and Givnish 2007).

The proposed removal of encroaching trees from historic meadows would increase the amount of herbaceous plants. Tree removal in dry montane meadows in the Cascade Range (Oregon) led to a 47 percent increase in herbaceous cover. Dry montane meadows exist in the Southwest Jemez project area. Tree removal here could result in more forage and a more even distribution of cattle across the pastures where treatments are implemented, leading to better grazing management.

Meadow treatments may have a relatively short (1 year or less) adverse effect on livestock, allotment management, and permittees. Depending on location, topography, size of treatment, and time of year the treatment is implemented, there may be a need to defer grazing in some areas. This type of deferment would mostly occur within riparian meadows and/or riparian pastures and is not likely to affect the management of an entire allotment.

Enhancement of Seeps and Springs

Removal of trees from around seeps and springs would reduce water use by trees. This water could be used by nearby grasses and herbaceous plants. Some of this water may also end up as groundwater or surface water.

Some seeps and springs directly supply water troughs and drinkers used by livestock. Treatments may increase water availability and/or increase the amount of time water is available at these livestock water sources. Some springs and seeps would be fenced off from livestock access, but these areas are very small in size compared to the area of an allotment. These treatments would benefit livestock grazing, allotment management, and the permittees, and no adverse impacts are expected.

Headcut Treatments

Headcuts can lead to a decline in rangeland health and soil stability (see chapter 2) for more detail on headcut treatments). As soil is eroded, herbaceous vegetation declines and sediment is deposited downstream.

The use of heavy equipment to repair headcuts is expected to have adverse short-term effects on herbaceous vegetation. Project vehicles and equipment would crush vegetation and disturb the soil. Recontouring the area may have greater impacts because a larger area of vegetation and soil would be disturbed. Seeding these areas with native grasses would help these areas recover and is one way to mitigate impacts (see appendix A for more measures).

Livestock may be kept out of recently treated areas, especially those on hillsides, to help recovery. Otherwise, headcut treatments are not expected to have adverse impacts on livestock grazing, allotment management, or the permittees, and would be beneficial over the long term. Treating these areas would stabilize the soil, promote an increase in herbaceous vegetation, and improve rangeland condition.

Treatments to Rehabilitate Dispersed Campsites and Plant Native Riparian Vegetation

Most of these dispersed campsites are found in stream corridors. The vehicles and equipment used in the treatments would disturb the soil and damage sensitive vegetation along the stream corridor. These effects are short term, and treated areas are expected to recover within one year. Newly planted herbaceous vegetation and woody species would also mitigate the initial impacts caused by the treatments.

Some areas would be fenced off to protect newly planted vegetation. Exclosures are not permanent and would be removed after 7-10 years, when vegetation is well-established and is capable of withstanding grazing and browsing. Building these exclosures would have short term-effects on livestock grazing and permittees, because these areas would not be available for grazing. The expected increase in pasture forage from using prescribed fire and mechanical treatments would offset these effects.

Treatment of Nonnative and Invasive Plants

This is an ongoing activity within all allotments. The treatments and their effects are discussed in the nonnative and invasive species section in this chapter. Right now, nonnative and invasive plant species can be treated with hand pulling or grubbing, prescribed grazing, and/or prescribed fire. Without treatments, native vegetation would be lost. The quality, quantity, and availability of forage for livestock grazing would be reduced.

The treatment methods listed above would not have an adverse effect on livestock grazing, allotment management, or the permittees. Usually, areas that are burned to control or contain plant populations would be no larger than 3 acres. Prescribed grazing with goats can occur concurrently with livestock grazing. None of these methods would interfere with permitted livestock grazing on any allotment. Treating these plant species would increase desirable native herbaceous vegetation and forage availability.

Building New Water Sources for Wildlife

Most of the existing upland water sources are available to wildlife and livestock. Providing additional water sources improves the distribution of grazing animals (elk, deer, cattle) on mesa tops and reduces the need for animals to travel long distances to find water. They also spend less time in sensitive riparian, seep, and spring areas.

Short-term adverse effects would result from this activity. Small areas of soil and vegetation would be disturbed during the construction of water sources. Vegetation at the site of the development would be damaged or destroyed by the heavy equipment and vehicles needed to install earthen dams, water catchments, trick tanks, drinking troughs, or guzzlers. Vegetation loss would occur on small localized areas. Vegetation is expected to recover within one year, based on past experiences with this type of project.

Additional water sources would benefit livestock grazing, allotment management, and the livestock permittees because these new water sources may also be available to livestock. Range capability would be increased because the areas that don't have water sources now would be available for grazing. A decrease in authorized numbers, season of use, deferment of grazing, or resting of pastures or allotments would not be necessary.

Creating Snags

Snags naturally occur on the landscape due to fire, insects, disease, wildlife, or lightning. They do not contribute to forage production, or compete with native vegetation for water and nutrients as they are no longer living organisms.

Snags would be created by girdling trees with hand tools to improve wildlife habitat. This would not result in a loss or increase of forage or range capability. There would be no adverse effects on livestock grazing, allotment management, or permittees.

Cultural Site Protection

Cultural sites have been considered in the environmental analyses (EAs) for each allotment and/or range improvement construction.

Cultural site treatments would not have an adverse effect on livestock grazing, allotment management, or the permittees. Some cultural sites presently have mitigation measures in place to limit the impacts of grazing to those sites.

Road Maintenance

Existing roads do not produce forage; however, they do facilitate allotment management by providing a way to travel throughout each allotment.

Road maintenance would benefit allotment management and livestock permittees. Improved road conditions would allow for easier travel with pickup trucks and livestock trailers. Road maintenance would also improve access to infrastructure such as livestock waters, pipeline systems, corrals, fencelines, wells, and other improvements used to manage livestock.

Opening Closed Roads, Constructing Temporary Roads, and Road Decommissioning Treatments

Opening existing closed roads or constructing temporary roads would result in a loss of herbaceous vegetation in these areas. This is a short-term negative effect. These effects would last during construction and while the roads are in use. As treatments are completed, roads would be re-closed or decommissioned and returned to their natural state.

Roads may be decommissioned with signs, physical barriers, vegetation, or eliminating the road bed. Road decommissioning treatments would benefit livestock grazing, allotment management, and the permittees. Native vegetation would be reestablished and fill in the road beds. Over time, the amount of available forage and species diversity would increase. Rangeland condition would gradually improve. Roads used to manage livestock or access fencelines, water tanks, and other range infrastructure would not be decommissioned, and so there would be no effects. Mitigation measures and design features (see appendix A) would minimize effects or damage to range infrastructure (fencelines, water tanks, etc).

Gravel Pits

Gravel pits would not exceed 5 acres in size per pit. Allotments are significantly larger in size. The loss of 5 acres would be outweighed by the benefits of the other treatments. Roads used to access these gravel pits would be improved and maintained. These roads may improve the ability of the permittees to access corrals, storage tanks, pipelines, and fences. Gravel pits would not have an adverse effect on livestock grazing, allotment management, or the permittees.

Alternative 2

Under this alternative permitted livestock numbers would stay the same. Ecosystem conditions would continue to decline. Tree densities would continue to increase. The probability of uncharacteristically severe wildfires would increase. Such a fire could leave the soil severely burned and sterile, as found in the Las Conchas burn scar. Conifer encroachment would continue and meadows would shrink or disappear. Native herbaceous species would continue to decline. Species abundance and diversity would continue to decrease resulting in a lack of available forage for livestock. Range capability is currently declining because of tree encroachment and would continue to do so.

Under this alternative, some areas would receive mechanical treatment or prescribed fire. However the amount of acres being treated within these projects is considerably less than those being proposed with this project.

Mexican spotted owl habitat or protected activity centers would not be treated. In these areas, herbaceous vegetation density or diversity would not increase and rangeland condition or forage production would not improve.

Alternative 3

Under this alternative, the effects would be somewhat different (with respect to grazing) on those areas that are burned rather than mechanically treated and then burned Also, there would be no effects from temporary roads because they would not be built. Without temporary roads, about 1,900 acres would not be mechanically treated and would receive prescribed fire only. The effects of mechanical treatments would be the same in this alternative as in alternative 1, but on fewer acres. All other treatments and their effects would remain the same as under alternative 1.

Alternative 4

The effects would be the same as under alternative 1, except for the effects from prescribed fire. Fewer acres would be burned because areas that are mechanically treated would not be burned. Instead, slash would be chipped or masticated. Some of it may be left on the ground or removed as firewood or other wood products. In some areas slash and woody debris would remain on site. In accessible areas, chipping or masticating material may occur. Large volumes of fuel would be on the ground. A wildfire burning through this fuel could damage the soil. These types of fuel beds retain heat for longer periods of time, allowing the soil to burn hotter. This can sterilize the soil and suppress vegetation growth (Busse et. al. 2005).

Layers of chipped or masticated material retain moisture and nutrients and keep them from reaching the soil where they can be used by trees and other vegetation. Trees, herbaceous vegetation, forbs, and shrubs are then suppressed. Heavy fuel beds keep grass and plant seeds from sprouting. An increase in herbaceous vegetation density and diversity, forage productions, and rangeland condition would occur at a much slower rate compared to areas that are treated with prescribed fire.

Alternative 5

The effects under this alternative would be similar to alternative 1. The reduction in acres burned in core areas, construction of fire control lines, and use of a 9-inch diameter cap in protected activity centers would not affect range management in those areas. The protected activity centers are considered as non-capable range and would be still considered as non-capable range regardless of whether they are treated. No range improvement structures exist within the core areas or in the areas of potential control lines.

Forest Plan Amendments

The proposed amendments would have little effect on range management under any alternative. The amendments allowing activities to occur during breeding season of some birds would be beneficial because there would be more time to complete infrastructure maintenance and new range projects.

Cumulative Effects

The area considered for the cumulative effects analysis is the entire project area because most of the allotments do not fall entirely within the entire project area. The cumulative effects analysis considered past, present, and reasonably foreseeable future non-project activities and their effects, in combination with the proposed action. These other activities are listed in appendix B.

The proposed activities listed in appendix B are not predicted to result in any long-term adverse impacts on current livestock grazing permit holders. Activities in appendix B are not expected to cumulatively add to project effects.

Cumulative effects would be the same for all action alternatives because the activities are the same, except for small differences in acreages for mechanical treatments and prescribed fire. Alternative 2 (no action) includes mechanical treatments and prescribed fire projects only, but at a much smaller scale.

Past, present, and future active forest management activities have the potential to increase the quantity and quality of available forage, improve range condition, and increase range capability. Wildfire could add to the cumulative effects for grazing allotments within the project area where treatments are being planned, ongoing, or have been completed.

The Valles Caldera National Preserve (Preserve) is located to the north of the project boundary. The Preserve is currently proposing restoration treatments similar to the ones analyzed in this DEIS.

Conclusions about the Effects of the Alternatives

This section responds to the analysis questions at the beginning of this section. The questions were developed in response to concerns raised during scoping.

What effect would the proposed activities have on herbaceous vegetation?

- The treatments that reduce tree density and fuels would increase the diversity and abundance of herbaceous vegetation, including forage plants: mechanical treatments, prescribed fire, meadow treatments, spring and seep treatments, headcut treatments, and treatments to control nonnative and invasive plants. Reducing tree density allows more light and moisture to reach the forest floor and stimulate plant growth. Mechanical treatments and prescribed fire would have the greatest effects.
- Gravel pits and associated access roads would result in a permanent loss of vegetation. The area involved is very small as compared to the entire allotment and would not be an adverse effect. Prescribed fire and activities that use heavy equipment and vehicles would damage vegetation. This would be a short-term effect and vegetation would recover in 1-3 years. The design features and mitigation measures (appendix A) would reduce impacts on permittees.

What effect would the proposed activities have on grazing and allotment management?

- Range capability would increase because more of the area would be accessible and usable. Cows would be distributed over a larger area instead of being concentrated in riparian areas, openings, or areas with fewer trees. Reducing tree density and increasing water sources have the largest effect on this because they result in increased forage production and better distribution of cows. Road maintenance activities would also improve allotment management. With better roads, it would be easier for permittees to get to and maintain fences, corrals, water sources and other improvements used to manage livestock.
- Some areas would not be available for grazing during or after treatments because vegetation, soil, or other resources would need time to recover. These effects would last 1-3 years. Exclosures to protect newly planted riparian vegetation would be in place for 7-10 years. The rest periods after prescribed fire treatments would have the biggest impact on the ability to continue grazing. The areas that would be closed are also much larger, covering one pasture or the greater part of an allotment.
- In general, effects on livestock grazing, allotment management or the permittees would be beneficial. Long-term benefits would outweigh short-term adverse effects.

How would the proposed activities affect the permittees?

- Prescribed fire treatments would have the greatest impact on permittees because of the rest period needed after a pasture or allotment is burned. Permittees may have to rest pastures or allotments, reduce livestock herds, reduce the season of use, or a combination of two or more of these actions. Alternate grazing opportunities are scarce or non-existent and some permittees could experience severe economic impacts. They would have less income because they cannot graze their cows and/or have to pay higher grazing fees to use alternate pastures.

- Other activities would increase forage production and improve livestock distribution. In the long term, there could be a small increase in income. Treatments would also reduce the potential for an uncharacteristically severe wildfire. This would reduce the risk of loss or damage of forage and range infrastructure and death or injury to livestock.

How would impacts on grazing be minimized?

- The district range staff have been meeting and consulting with the permittees about the project and its potential impacts. This will continue throughout the planning and implementation phases. This is also being addressed through the design features and mitigation measures (see appendix A). These would minimize the amount of restoration treatments affecting an allotment at any given time.

Recreation

The recreation specialist report (Harris 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations. The roads and engineering specialist report has more information on dust, noise, safety, and traffic. The social science, economics, and environmental justice specialist report has information on economic impacts related to recreation.

Affected Environment

Recreation Use and Visitation

The Jemez Mountains are often called the "backyard of Albuquerque;" there are nearly 1 million people within 50 miles of the area. The nearness to a diverse and desirable outdoor recreation destination area attracts many types of recreationists. The project area has many developed recreations sites, and dispersed[15] recreation areas (Figure 27). The local demand for forest recreation is expected to grow in proportion to the growth of the Albuquerque metro area.

An estimated 591,000-676,000 people visited the Jemez Ranger District in 2012. Holiday weekend visitation can increase dramatically. For example, on Memorial Day weekend in 2003, visitation was 163 percent above the average weekday (MRCG 2006). The majority of forest recreation users travel New Mexico (NM) Highway 4 from the Albuquerque Metro area. Almost all of the Jemez Ranger District developed recreation sites are found along NM Highway 4 and 126. The notable exception is Paliza Family and Group campgrounds, which are located off Forest Road 10 on the east side of the project area.

Recreational visits and activities vary by season. In early spring (April and May) there is a dramatic increase in day use hikers. Trailhead parking is full during weekends and mostly full during the week days. Forest roads are opened to the public in mid-April and visitors begin to use the dispersed camping areas. By early May the developed sites are open to the public and are busy throughout the summer months. Campgrounds and dispersed camping areas continue to be used during the fall big game hunting seasons. As winter approaches the most developed sites are

[15] Dispersed recreation is recreating (camping, picnicking) away from developed sites. These areas usually do not have Forest Service facilities: picnic tables, a water supply, or toilets. Fees are not usually charged to use these sites.

winterized and closed. Forest roads typically close in early January and are used as cross country ski and snow mobile trails.

Developed recreation sites are heavily used during the summer months, Memorial Day weekend through Labor Day. Use spikes on summer holidays (Memorial Day, July 4th and Labor Day) and on weekends in all developed recreation sites. Camping sites in San Antonio Campground can only be reserved online, and this campground is normally full throughout the summer. Vista Linda Campground is open year-round, and is mostly used during the spring and fall months.

Figure 34. San Antonio Campground is one of the most popular campgrounds in the area.

Many forest recreation users prefer a more primitive recreational experience than the developed campgrounds and picnic areas provide. Motor vehicle dispersed recreation corridors are located along the major proposed transportation routes that would access implementation sites. Forest Road 376 goes through the most used motor vehicle dispersed recreation area in the project area and on the forest. An estimated 97,000-110,000 people travel on this road every year. Forest Road 10 is another highly used motor vehicle recreation corridor; 93,000-107,000 people travel through and recreate along this road every year. Forest Road 10 provides primary access to other dispersed recreation areas along Forest Roads 266, 270, and 269.The dispersed camping corridor along Forest Road 144 serves as an overflow area for the Forest Road 376 recreation area when it is full

The 10-mile East Fork Trail (Forest Trail 137) runs from Las Conchas to Battleship Rock Picnic Area and is a high use facility from late April through October (figure 35). Segments of the trail parallel the East Fork Jemez Wild and Scenic River and users access the trail from several trailheads and the Jemez Falls Campground. Other trails within the project area receive minimal use throughout the season.

Figure 35. Aspen and ponderosa pine along the the East Fork Jemez Trail. This is the most popular trail on the district.

Recreational Sites and Activities

Several congressionally designated recreation areas are within the project area: the East Fork Jemez Wild and Scenic River, the Jemez National Recreation Area, and the Jemez Mountain Trail National Scenic Byway (figure 37). The Jemez National Recreation Area covers 57,650 acres, including about 9,400 acres of private lands. About 30 percent of the project area (32,900 acres) is within the national recreation area. The East Fork Jemez Wild and Scenic River corridor runs 11 miles along the southern boundary of the Valles Caldera National Preserve. The Jemez Mountain Trail National Scenic Byway follows State Highways 4 and 126. State Highway 4 is also a popular one-day loop drive connecting Albuquerque with Los Alamos and Santa Fe and is the main access to the developed campgrounds, picnic areas, and trailheads.

Except for one picnic area (Seven Springs) all of the developed[16] recreational fee sites on the Jemez Ranger District are located within the project boundary. There are 6 campgrounds, 5 picnic sites, and 7 fishing sites. There are also 4 trailheads, a scenic overlook, and two hot springs site. Most developed sites are open April to October. Forest roads and motorized trails are open from mid-April through December.

People prefer to use areas along the rivers, streams, and recreation sites along State Highway 4 in the Jemez National Recreation Area. The Jemez River and East Fork Jemez River corridors have long been a recreation destination for visitors from the region and from around the country. Other streams and rivers located within the national recreation area include San Antonio River, and Rio Cebolla in the Forest Road 376 dispersed recreation corridor.

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[16] Developed recreation sites have Forest Service facilities such as picnic tables, a water supply, and toilets. Fees are usually charged to use these sites.

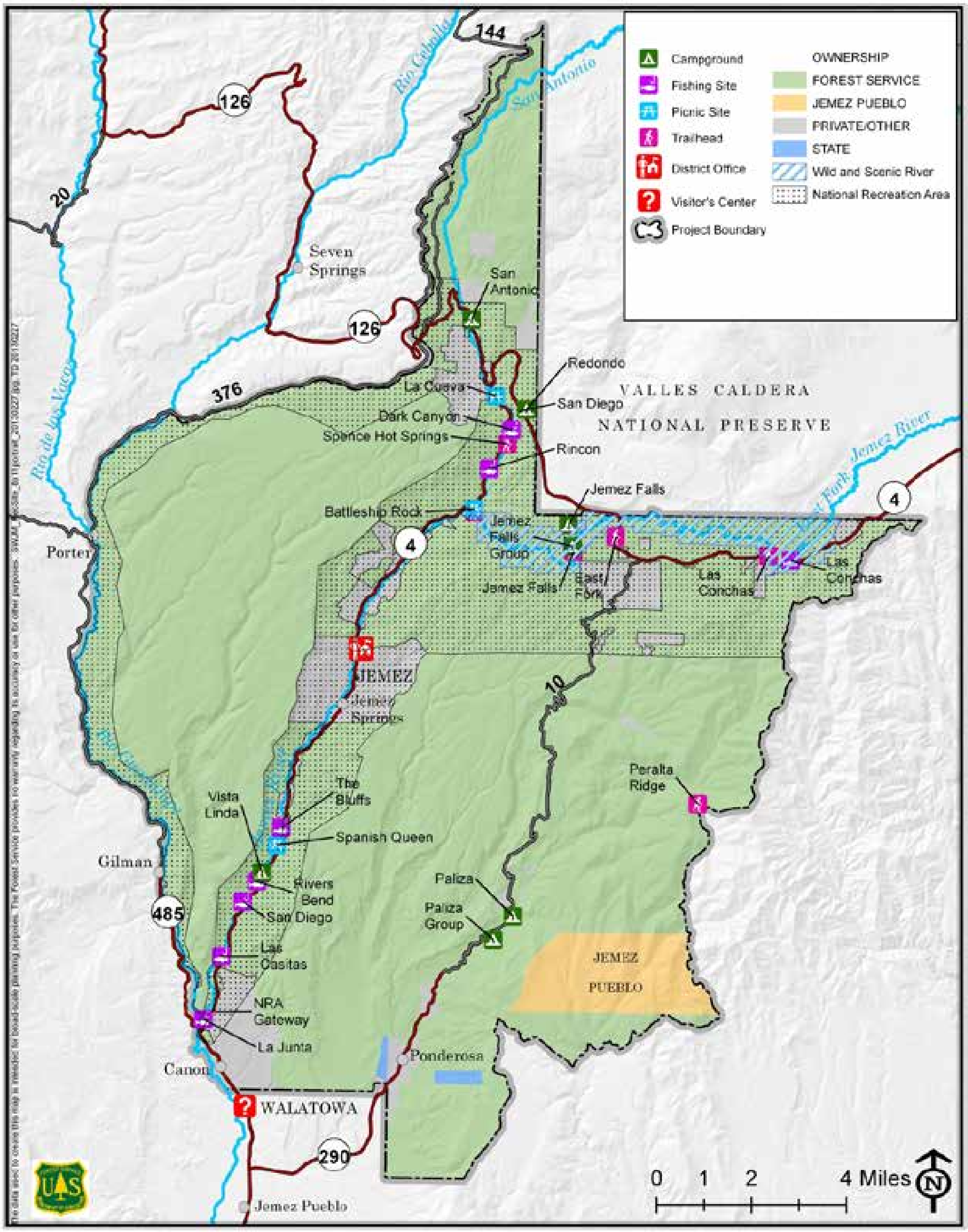

Figure 36. Locations of developed recreation areas and roads. Most of the developed sites are along the Jemez River and Highway 4.

Local users focus their recreation activities around family gatherings where there is water. This means camping and picnicking along or near rivers and streams. Other popular activities are hiking, fishing, photography and sightseeing. Riding motorcycles and all-terrain vehicles (ATV) on forest roads and motorized trails is popular. The mesas, especially Virgin Mesa, are favorite areas for motorcycle and ATV riding.

In the winter, cross-country ski, snowmobile, snowshoe, and family snow play days. Forest Road 144, when snow-covered, is used extensively for snowmobiling and cross-country skiing. The Los Griegos cross-country ski touring area is another popular winter destination. Most snow play occurs near the highways, where families can be closer their vehicles.

Hunting is a popular activity in the fall. Most hunters set up camps in dispersed recreation areas along Forest Roads 144 and 376. Jemez Falls Campground is the only developed site open during the hunting season. Hunters with permits for the Valles Caldera National Preserve game units also camp in the area because camping is not allowed on the Preserve.

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) classifies a range of outdoor recreation settings, activities, and opportunities from those with a very high probability of solitude, self-reliance, risk, and challenges, to a very social experience where self-reliance, challenge, and risk are relatively unimportant. Four of the six ROS settings are found in the project area: Roaded Natural (49,815 acres); Semi-Primitive Motorized (48,670 acres); Semi-Primitive Non-Motorized (384 acres) and Rural (10,057acres) (figure 37). The Roaded Natural and Semi-Primitive Motorized ROS settings comprise approximately 90 percent of the project area.

Methods

Information from the National Visitor Use Monitoring surveys (NVUM 2012) and traffic counts from the New Mexico Department of Transportation were used to estimate the number of visitors to the area. Information on the type and frequency of recreation activities was provided by the Statewide Comprehensive Outdoor Recreation Plan (New Mexico State Parks 2009). Information on recreation site use and fee revenues comes from Jemez Ranger District records and was used to estimate monthly use at developed fee sites.

Analysis Questions

The main purpose of the project is to create forest resiliency to catastrophic wildfire and improve ecosystem processes. The purpose and need does not directly address recreation. One comment from the public involvement effort addressed recreational opportunities and concerns: displacement of hunters and hunting camps from dispersed recreation areas. Because there were few comments related to recreation, we used forest plan direction and the possibility of creating positive recreation opportunities and experiences to develop the analysis questions:

- Are proposed project treatments consistent with the direction for recreation in the Santa Fe National Forest Land and Resource Management Plan (1987, as amended)?
- Would project treatments disrupt or displace recreational visitors?
- Would implementation activities enhance the variety and range of recreation opportunities and settings after the project is completed?

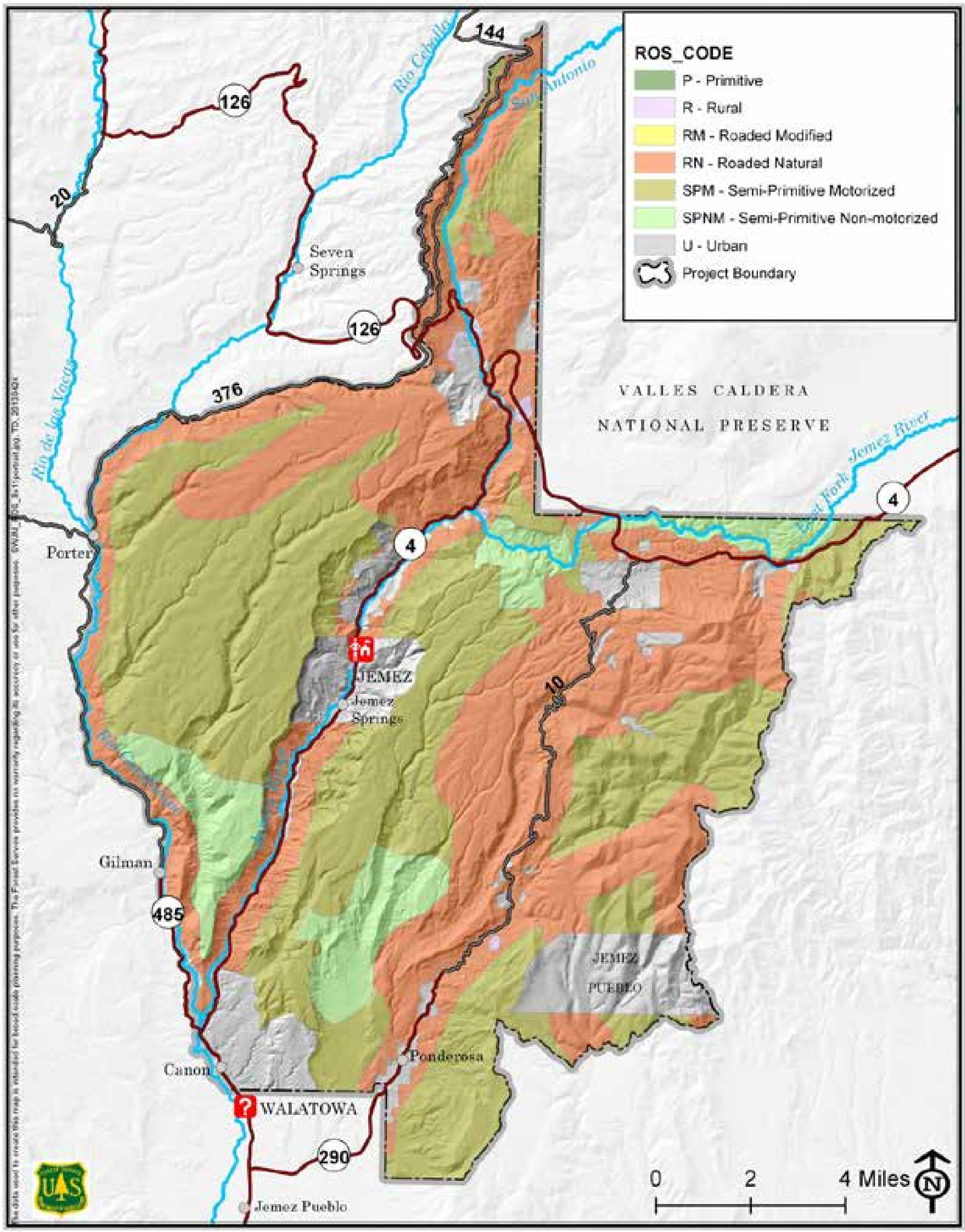

Figure 37. Recreation Opportunity Spectrum Settings. Most of the area is classified as Roaded Natural or Semi-Primitive Motorized.

Summary of Effects

Alternatives 1, 3, 4, and 5

Impacts from project activities include increased dust and noise from vehicles and equipment use, temporary closures of recreation areas and roads, increased traffic on highways and forest roads, and smoke from prescribed fires. These would disrupt recreation opportunities and displace visitors. These effects are short term and the degree of disruption to recreation site users would vary, depending on time of year, and the location, timing, and intensity of treatments. Increased traffic on roads and smoke could affect public health and safety. There would be fewer impacts from smoke under alternative 4.

Alternative 2

There would be fewer impacts on recreational users and opportunities under alternative 2. Without the treatments, the risk of accidents from falling trees and snags and woody debris on the forest floor would increase in dispersed areas and along trails. Some recreation opportunities and experiences may become more limited as forest conditions decline.

Environmental Consequences

Effects Common to Alternatives 1, 3, and 4, and 5

Developed Recreation Sites

There would be an increase in traffic and road noise from logging trucks and other vehicles used to implement the restoration treatments[17]. Heavy equipment (logging trucks, skidders, bulldozers) traveling on the highways would likely cause traffic to slow down. Vehicle noise would be audible in campgrounds and picnic areas located adjacent to the transport routes.

Noise and dust from mechanical treatments taking place next to developed recreation sites during the summer months when concentrated use occurs would have a greater impact on visitors. Use of tree harvesting equipment, vehicles, and related traffic at staging areas close to developed recreation sites would disrupt recreational experiences.

Traffic noise may disrupt the experience of people staying in campgrounds and picnic areas along Highways 4 and 126. Evening and night traffic from log trucks and project equipment would be light. But traffic noise from evening and night travel would have a greater impact on campers because visitors are in the campgrounds at this time. Daytime travel may have fewer impacts because many campers are elsewhere during the day. Picnic area users, however, would be more affected during the day because these sites are only open during the daytime.

People camping, fishing, or picnicking at the developed recreation sites along the lower Jemez River would not be affected by traffic noise because there are no proposed mechanical treatment and prescribed fire sites within Lower San Diego Canyon. People recreating at Vista Linda Campground, Spanish Queen Picnic Area, and several fishing access sites might be affected by additional traffic noise from project equipment and logging and gravel trucks using Highway 4. Dust and traffic noise from project vehicles should not impact people using the Jemez Falls Recreational Complex because these sites are well off the highway.

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[17] An estimated 12 log-haul truck round trips per day may be associated with mechanical treatments, according to the roads and engineering specialist report.

Project vehicles using Forest Roads 604 and 376 to Virgin Mesa and areas north of La Cueva would pass by San Antonio Campground and La Cueva Picnic Area. Vehicles going to treatments sites on the east side of the project area would likely use Forest Road 10, which goes through the community of Ponderosa and passes directly by the Paliza Family Campground. Numerous side roads lead to specific treatment sites. Dust from passing truck traffic would affect campers at the Paliza Family Campground because it is close to Forest Road 10. Activities at nearby treatment sites might also affect campground visitors with traffic noise. No traffic related impacts are expected at the Paliza Group Campground because it is set well off the road.

Effects from noise and dust would be short-term and would vanish when treatments are completed. These impacts would be incremental to existing issues with road dust and noise, especially along the Forest Road 376 dispersed recreation corridor.

Dispersed Camping Corridors and Hiking Trails

There are 22 miles of motorized dispersed camping corridors located along Forest Roads 376, 604, 144, and 10. These are also popular roads for ATV and motorcycle riders. These roads would also be the main access roads to treatment sites. Visitors camping in these corridors or riding on the road would be impacted by trucks and other vehicles traveling to and from treatment sites.

Traffic noise and road dust would impact people recreating in the motor vehicle dispersed recreation corridors along Forest Roads 376, 604, 144, and 10. These effects would be short term, perhaps lasting as long as 15 minutes while the dust settles, but could happen several times per day.

People who want to camp on Virgin Mesa during the summer would be displaced because these areas would be closed to camping while the mechanical treatments and other project activities are taking place. Most of these treatments would take place during the summer months, but hunters may also be displaced during the spring and fall.

Hunters may be displaced from their traditional camping sites by treatment activities. They would need to find a different place to camp or stay in a developed campground. Hunters camping along Virgin Mesa (Forest Road 604) are most likely to be displaced. There are not many treatments planned in the motorized dispersed camping and big game retrieval corridor along Forest Road 144 and users would probably not be displaced. On the east side of the project area displacement can be expected in the area around the junction of Forest Road 266 and Forest Road 137.

The East Fork Trail (Forest Trail 137) is the most highly used hiking trail in the project area. Project treatments would have short-term impacts on hikers using that trail. Noise from mechanical treatments (vehicles, chainsaws) would lower the quality of the expected experience; hikers would not be able to hear the sounds of nature, such as bird songs, running water, or rustling leaves. As treatments are completed, the open forest conditions may be more desirable for dispersed recreation use, thus expanding the dispersed recreation opportunities.

Other Recreation Uses

Some visitors to the forest and project area have a more passive recreation experience; they drive for pleasure, view wildlife or simply relax and get away from the Albuquerque heat for a couple of hours. Many people drive the Jemez Mountains Trail National Scenic Byway loop. Project-related truck traffic would add more vehicles to the highways and forest roads. This extra traffic may affect the driving or riding experience.

Temporary roads would provide additional motor vehicle access into the forest. The additional access would not be consistent with the Travel Management Decision. Temporary gates to restrict public access or active patrolling might mitigate public access issues and provide for greater public safety.

The open forest conditions resulting from mechanical treatments would improve seasonal recreation activities and have beneficial effects. The driving and sightseeing experience would be enhanced by the open viewsheds and scenery. Cross-country skiing and other winter recreation would be enhanced by easier access and travel. Wildlife would be easier to view and photograph in open forest areas. Hunting would also be enhanced by easier foot travel through forested areas.

All Activities

Longer term beneficial effects include a reduced risk of wildfire and the creation or enhancement of current forest recreation opportunities such as winter recreation, hiking, and camping. Wildlife habitat improvement projects would enhance hunting and fishing opportunities.

Prescribed fire smoke may reduce visibility as it is transported down drainages and could possibly cause respiratory issues to some recreational users. Smoke would have fewer effects on users of developed sites because burning would occur in the spring and fall when few recreation users are present in the project area and developed sites are closed. Smoke would affect people using the area in the off-season. These impacts would be short term. Please see the air quality specialist report for more information on smoke impacts.

Alternative 2

Over the short term, there would be much less disturbance to the recreational user. Benefits from the treatments would not occur. The risk of accidents from falling trees and snags and woody debris on the forest floor would increase in dispersed areas and along trails. Some recreation opportunities and experiences may become more limited as forest conditions decline.

If an uncharacteristically severe wildfire occurred, recreational activities could be adversely impacted. Large areas of the district could be closed to public access after a wildfire and would displace dispersed campers, hunters, and day use visitors. The trail system, developed sites, and dispersed camping sites could be damaged or destroyed by a wildfire and/or post-fire flooding. In the short term, the dispersed sites may be lost due to post-fire flooding. Depending upon the severity and extent of the wildfire, nearly all recreational activities would be greatly affected for many years after the event. For example, large parts of the district were closed after the Las Conchas fire in 2011. Although the closure order has been lifted, recreation use has not recovered to pre-fire levels.

Alternative 3

Temporary roads would not be built under this alternative, and 1,900 acres would not receive mechanical treatments. This may have positive impacts on forest recreation. This would eliminate the opportunity for additional unauthorized motor vehicle access routes into the forest and limit potential recreation user conflicts. It would also limit unauthorized use under the Travel Management Decision. There would be no effects on recreation because the untreated areas are located in remote areas away from existing roads and removed from most forest recreation opportunities. Other effects, such as noise, dust, displacement, and enhanced recreation opportunities, would be the same as those described for alternative 1.

Alternative 4

Prescribed fire treatments would be implemented on approximately 31,600 fewer acres than under the proposed action. This would reduce the total amounts of smoke by one-third over the life of the project. Smoke impacts on off-season recreationists would be reduced as compared to other alternatives.

Slash from mechanical treatments would be masticated, chipped, or lopped and scattered and left on the forest floor instead of burned. There would be more woody debris and fuel on the forest floor. These areas would be more susceptible to wildfire and the debris and slash would limit recreation user access and safety in these areas. Other effects from the treatments would be the same as those described for alternative 1.

Alternative 5

Approximately 700 fewer acres would be treated with prescribed fire under this alternative. The reduction in smoke would not be noticeable. The effects from smoke would be the same as described for alternative 1. Under this alternative, more acres are treated in Mexican spotted owl restricted habitat. These areas are remote and the additional noise, dust, and duration of treatments are insignificant and would not affect recreational use or recreationists. The diameter cap would also have no impacts on forest recreation. Other effects from the treatments would be the same as those described for alternative 1.

Forest Plan Amendments

All of the proposed site-specific forest plan amendments would be needed for alternatives 1, 3, and 4. The proposed plan amendments would have no effect on sustainable forest recreation in the project area.

Alternatives 1, 3, and 4

The amendments regarding treatments in Mexican spotted owl habitat would have no effect because most protected activity centers are not located near any developed recreation sites. One protected activity center is located along a motor vehicle dispersed recreation corridor, but there would be no effect because no implementation is proposed in that corridor.

Alternatives 1, 3, 4, and 5

The amendments related to interspaces in goshawk habitat and conducting surveys in peregrine falcon areas would have no effects on recreation use or activities. There would be no effects from forest plan amendments related to northern goshawk or peregrine falcon because these raptors coexist with developed and dispersed sites and areas.

The amendments allowing activities to occur during wildlife breeding seasons may increase noise disturbances to visitors depending on time of year.

The amendment regarding changing the Visual Quality Objective to “High” would not change how recreation is managed within the project area.

Cumulative Effects

Cumulative consider the interaction of effects from the project activities and foreseeable impacts from other planned and unplanned activities in the project(see appendix B for past and planned projects).

Over the last 20 years, numerous wildfires have affected forest recreation in the project area. These fires have displaced and closed areas to forest recreation, both in developed sites and dispersed areas. Fire restrictions and closures in early summer months range from campfire prohibitions to forest closure to any public entry. Prescribed fires have temporarily closed areas to recreation use, however prescribed fire treatments are scheduled only when wildfire risk is low in the late fall and early spring when few recreation users are on the forest. Prescribed fire would open the forest understory and clean the forest floor which positively impacts recreational user access during all seasons for years to come.

Completed projects have benefited and improved forest recreation facilities and experiences. Mechanical treatments taking place adjacent to developed recreation sites (e.g., Jemez Falls, Paliza Family and Redondo Campgrounds) has reduced the risk of campfire caused fires while improving scenery and forest access. Trail bridges on the East Fork Trail and over the San Antonio River keeps hikers dry while maintaining the integrity of the stream bottoms. Parking areas at Spence and San Antonio Hot Springs have benefited the public by providing structured parking and trailhead information to the springs. Moving parking areas away from riparian and streams improves water quality. Rehabilitating back country camping sites along the rivers enhances hiker experiences while keeping sediment from entering the streams. Range allotment fences keep livestock away from campgrounds and picnic areas.

Cumulative effects on forest recreation would be mostly positive and beneficial. Implementation of restoration treatments on the Valles Caldera Preserve, adjacent forest lands, and Jemez Pueblo would reduce the risk of high-severity wildfire and/or insect outbreaks which would reduce the likelihood of summer time forest closures to the public.

Conclusions about the Effects

This section answers the analysis questions and how well the alternatives address the purpose and need and the relevant issues.

Are proposed project treatments consistent with the direction for recreation in the Santa Fe National Forest Land and Resource Management Plan (1987, as amended)?

- Proposed treatment activities would be consistent with recreation management under the ROS classification across the project area. The Roaded Natural and Semi-Primitive Motorized ROS settings comprise approximately 90 percent of the project area and proposed implementation treatments would be in short term and mostly consistent with the values associated with each setting. There are approximately 300 acres of mechanical treatments proposed in the Semi Primitive Non-Motorized ROS setting in the in the East Fork Jemez Wild and Scenic River; motor vehicles are not permitted in that setting. Noise from mechanical treatments would possibly conflict with the recreational experience values, but this would be a short-term effect. Effects from treatments are similar under all action alternatives.

Would treatment activities disrupt or displace recreational visitors?

- Project activities would disrupt recreation opportunities and displace visitors under all action alternatives (1, 3, 4, and 5). Equipment noise and dust from mechanical treatments taking place next to developed recreation sites would have greater impacts during the summer, when recreation use is heaviest. These effects are short term and the degree of disruption to recreation site users would vary, based on the specific location of treatment sites, timing of activities, and intensity of treatments. Activities taking place during the summer (Memorial Day to Labor Day) would have greater effects on the recreating public because this is when the most people are visiting and recreating in the area. Fewer visitors would be affected at other times of the year. For example, mechanical treatments occurring close to developed recreation sites would have a greater impact during the summer when these facilities are heavily used. The time of traffic activity is important; traffic noise between 6 p.m. and 7 a.m. would have a greater impact on overnight campers.

- Some dispersed recreation areas and corridors and forest roads may be closed for public safety while treatments are being implemented. Displaced recreationists would have to go somewhere else on the district or go to another area. Traffic and other transportation related impacts would be incremental to existing conditions and would affect both developed and dispersed recreation users. Currently, road dust is a nuisance and congestion on forest roads and vehicle accidents are an issue on holidays and summer weekends.
- Effects from smoke would be short term and limited, as most prescribed fire treatments would be done in the off-season when developed sites are closed and fewer recreation users are on the forest.

Would treatment activities enhance the variety and range of recreation opportunities and settings after the project is completed?

- As treatments are completed the open forest conditions may be more desirable for dispersed recreation use, thus expanding the dispersed recreation opportunities.
- Forest recreation opportunities and experiences would be enhanced. Wildlife habitat and stream treatments would improve fishing, hunting, and wildlife viewing opportunities. Treatments that reduce fire hazard would reduce the likelihood of forest closures during the summer. A more open forest would improve seasonal recreation. Cross-country skiing, snowshoeing, and other winter recreation would be enhanced by easier access and travel through less dense forested areas.
- Long-term effects would be beneficial and positive. Reducing the fire hazard would result in fewer forest closures and other disruptions to recreation use during the summer season. A more open forest with openings and edge habitat would improve scenic quality, wildlife viewing, hunting, and winter recreational activities. Aquatic habitat and watershed treatments would enhance fishing and streamside recreation.
- Although short-term impacts would occur there would be other unaffected recreation sites and opportunities in the area that the public may use. Most impacts related to noise and fugitive dust in motor vehicle dispersed recreation corridors would be incremental to existing conditions. Road dust from unpaved forest roads already is a nuisance and inconvenience many dispersed recreational users. Forest road congestion and vehicle accidents are an issue on summer holidays and weekends.

Roads and Engineering

The roads and engineering specialist report (Holliday 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations.

Affected Environment

The Existing Road System

There is a well-established road system in the project area. Figure 38 shows the roads in the area needed for project activities. The road density is high, averaging 3 to 6 miles of road per square mile in some areas. This is well above the forest plan standard of 2 to 3 miles of road per square mile. Some of these are user-created roads, made when people drive a vehicle off the main road to get to a campsite, hunting spot, or other place. These user-created roads are not maintained and are in poor condition. Most of the forest system roads are in fair to poor condition especially at stream crossings and some have severe impacts on riparian areas and water quality. There are no open or active gravel pits in the area. There are a few closed pits on forest land that could be reopened and there also some areas with suitable rock where we could build new pits.

Traffic

Traffic counts are ongoing[18]. Currently, traffic on most forest roads in the area is low. Table 20 lists the annual average daily traffic for some of the major forest roads in the project area. We use traffic counts to rank the roads from busiest to least busy. Forest Road 376 is the busiest road in the project area and on the entire forest. This is a very popular recreation area and traffic on forest roads and state highways is heaviest on the weekends, as described in the recreation section of this chapter.

Table 20. Traffic on forest roads in the project area

Road Number	Location of Traffic Counter	Average Annual Daily Traffic
376	Before tunnels	581
376	After tunnels	207
376	Porter Landing	193
10	Before Paliza Campground	185
10	Above Paliza Campground	35-50
604	Beginning of road	50

Impacts of Roads on Resources in the Project Area

The high road density and poor road conditions are impacting forest resources. The high density of roads lowers the quality of wildlife habitat and disturbs wildlife. Some roads go through sensitive breeding and nesting habitat. Other roads go through or near cultural resource sites. These sites are damaged when vehicles drive over or next to them and by erosion runoff from roads. Sediment from road erosion gets into streams and impacts fish habitat and water quality. Roads facilitate the spread of nonnative and invasive plant species; vehicles carry and spread seeds around the area. The wildlife, cultural resources, and nonnative invasive plants sections of this chapter have more details on the adverse impacts of roads on these resources.

[18] The recreation specialist report also has information on traffic counts. In that report, traffic counts are measured in vehicles per day.

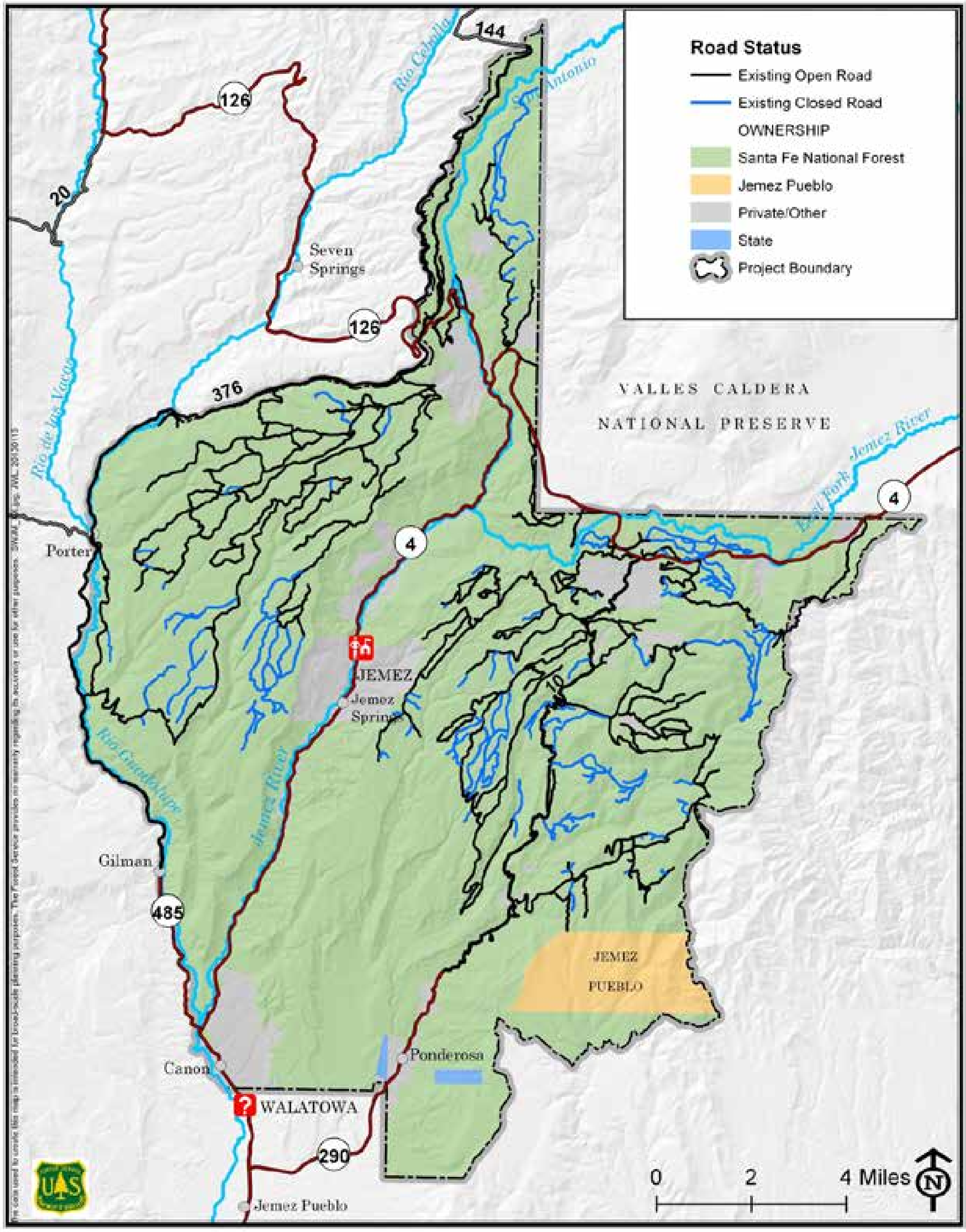

Figure 38. Roads in the project area that would be used to access treatment sites.

Methods Used to Analyze Effects from Road Treatments

We looked at the road system using field visits and observations, maps produced from the forest Geographic Information System (GIS) database, the Infra database[19], personal consultation with other forest employees who are familiar with the area, and professional judgment based on past experience. The coverage count method[20] was used to calculate the annual average daily traffic amount of traffic on forest roads.

Analysis Questions

The analysis questions were derived from the purpose and need and the issues that arose during scoping as described in chapter 1. The relevant analysis questions are:

What are the effects of increased traffic on the human environment?

Would impacts from roads on the environment be reduced by the road treatments?

What are the effects on the environment of opening roads and building temporary roads?

Summary of Effects

Effects from roads, construction of temporary roads, and gravel pits on other resources are also discussed in these sections of chapter 3: cultural resources, nonnative and invasive plant species, recreation, scenery, soil and water resources, and wildlife, fish, and rare plants.

Road treatments would occur under all alternatives, including the no action, as shown below.

Table 21. Amount and type of road work, by alternative

Type of Treatment	Alternatives 1, 4, and 5	Alternative 2	Alternative 3
Temporary roads built	12 miles	0 miles	0 miles
Roads re-opened, maintained, and then closed	107 miles	0 miles	96 miles
Open roads maintained	242 miles	47 miles	242 miles
Roads decommissioned	Up to 100 miles	2 miles	Up to 100 miles

Effects from road maintenance include noise, dust, and increased traffic, which could disturb wildlife and forest visitors. The greatest increase in traffic would occur on Forest Roads 10, 376, and 604. These effects would be minor, localized, and short term under all alternatives. Other effects include soil disturbance and erosion.

Decommissioning roads would also have similar short-term, localized effects. Over the long term, adverse effects on wildlife, cultural resources, and water quality would be greatly reduced or disappear. These effects are similar for all alternatives.

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[19] The Infra database is an inventory of constructed features (buildings, campgrounds, trails, etc.) and land units, and permits sold to the public and to partners.
[20] To calculate traffic on a road, we count traffic for two weeks, take the 30th highest hour of traffic, and divide that by 0.14. The result is approximately equal to the annual average daily traffic.

Effects from temporary road construction and use include noise, dust, and soil disturbance. These effects are the same under alternatives 1, 4, and 5. There are no effects under alternatives 2 and 3 because temporary roads would not be built.

The effects of gravel pit development include noise, dust, traffic, and soil disturbance. These effects are the same under all action alternatives. Gravel pits would not be built under alternative 2, so there are no effects.

All alternatives have the potential to increase the establishment and spread of nonnative and invasive plants. This potential is highest under alternatives 1, 4, and 5. It is slightly less under alternative 3 because no temporary roads would be built, and lowest under alternative 2 because a smaller area is being treated and there is less soil disturbance and vehicle traffic.

Beneficial effects, such as reduced soil erosion, lower amounts of sediment in streams, and protection of cultural resources, would be highest under alternatives 1, 3, 4, and 5 and lowest under alternative 2 because fewer miles of road would treated and only 2 miles of road would be decommissioned under this alternative. See the soil and water resources section of this chapter for more on beneficial effects on water quality.

Environmental Consequences

Effects Common to Alternatives (1, 4, and 5)

Changes in Traffic

Increases in traffic related to wood product removal are about the same under each of the action alternatives. It is slightly lower under alternative 3 because fewer acres are treated, but the difference is minor.

Alternatives 1, 4, and 5 would generate approximately 12 round trips each day over the life of the project. Alternative 3 would generate approximately 11 round trips per day over the life of the project. The increase in traffic would occur in one unit of the project area. There would be no increase in traffic over most of the rest of the area. Noise and dust from the additional traffic would be localized in the area where project activities are occurring.

The other restoration treatments would also generate additional traffic road use. Heavy equipment would be hauled in and out for the mechanical treatments, road work, and instream habitat work. People and equipment would be brought in for the prescribed fires. There would also be equipment doing road work and trucks hauling gravel to work sites. These trips are of short duration, lasting a few days to a week while the project activities are being implemented.

Traffic would also increase on non-Forest Service roads. The heavy equipment and log trucks would travel on State Highways 4, 126, 290, or 485. Depending on where material is processed, some of this traffic would pass through Jemez Springs, Ponderosa, La Cueva, and Vallecitos de los Indios, and nearly all of it would pass through Jemez Pueblo and San Ysidro. The amount of additional traffic that would pass through these communities would depend on where the work is occurring and the destination of the vehicles.

Noise, Dust, and Safety

Increased traffic, especially from the larger, heavier vehicles used for treatments, would increase noise and dust. The effects from noise and dust are expected to be minor, and would not be confined to one area. Noise and dust from the additional road use would be in the area where project activities are occurring and would be scattered over the project area over the life of the project. As a result, these impacts would not be excessive in any one area.

The amount of noise would depend on the number of and type of vehicles; eighteen-wheelers are louder than pick-up trucks. Most of the mechanical treatments are along or near Forest Roads 10, 376, and 604. People living and recreating in those areas would hear more noise. The noise of a passing truck may be noticeable for a few minutes, and would be about as loud as an airplane or an ATV. The ATV might even be louder than the logging truck (Grubb et al. 2012[21])

The heavy equipment and vehicles traveling on dirt roads could raise a lot of dust, depending on the road surface and condition. Dust created by vehicle traffic wouldn't travel far, but could settle in recreation sites and residential areas adjacent to the road. The amount of dust from the project is expected to be minor, localized, and of short duration. Dust would reduce visibility, which could result in accidents. The areas along roads 376 and 10 are popular camping areas and people using those areas would potentially experience more problems with dust.

Public safety may be affected by dust and heavy equipment traveling on forest roads. There is heavy truck traffic on the highway now. Although not operating now, pumice mines operated along Forest Road 10 for many years. The pumice trucks hauled along the state highways without any accidents. In areas where treatments are occurring, signs would warn visitors about the heavy truck traffic. Hauling would not take place on weekends during the high recreation use season (Memorial Day to Labor Day). This would minimize noise, dust, and safety concerns in high recreation use areas near treatment areas. Other design features and mitigation measures (appendix A) would also limit the impacts of noise, dust, and traffic.

Road Maintenance

Cleaning road drainage structures- culverts and lead-out ditches- would allow water to flow more easily in the designed runoff channels. This would reduce soil erosion and reduce the amount of sediment in streams. Removing hazard trees that might fall on the road or trees that reduce sight distance for drivers would improve safety. These road maintenance activities would also create noise, dust, and traffic with effects as discussed above.

Opening Roads

Some roads are currently closed to public use, but we would open them to implement project activities. The extent of work needed to open a road would depend on how it was closed and how long it has been closed. Some roads may only require removal of berms, rocks, or other barriers, while others would require extensive work, similar to heavy road maintenance. Roads would be maintained during use and then closed after activities are completed. During the process of re-opening these roads, culverts would be cleaned and drainage problems would be corrected. This would reduce impacts on other resources.

Re-opening and using these roads would create more noise and dust while activities are being carried out. These effects are discussed above. The opening and closing of these roads will be

[21] Grubb et al. 2012 is a study looking at the effects of logging truck noise on northern goshawks. The paper contains a table showing noise, measured in decibels, of various types of vehicles. Road maintenance equipment- 100 decibels; ATVs- 90-100 decibels. In the study, empty logging trucks on a dirt road ranged from 55-67 decibels; aircraft flying overhead, 59-68 decibels.

defined in detail by contract specifications with the objective of minimizing impacts on soil and water, wildlife, recreation and cultural resources.

Decommissioning Roads

The effects from this activity would be different depending on what we do to decommission a road: removing the road and re-grading it, or leaving it alone and letting it revegetate naturally, or installing barriers.

Removing the road and re-grading it would have effects similar to road construction. The heavy equipment would create noise and dust. Ground disturbance could lead to erosion and create opportunities for invasive plant species to spread. The effects from noise and dust are similar to those talked about previously. Effects of road decommissioning on other resources are discussed throughout this chapter.

Temporary Roads

A temporary road is a road authorized by contract, permit, lease, or other written authorization that is not a forest system road and that is not included in a forest transportation atlas. Temporary roads for the stewardship contract will be constructed by the contractor at their cost. The temporary roads would be adequate for logging equipment and trucks to get from treatment sites to a landing or main road. They would not be suitable for passenger cars. Temporary roads would be decommissioned after use.

Construction and use of temporary roads would increase noise and dust as discussed above. Impacts on public safety would not occur because the temporary roads would not be open to public use and would not be suitable for passenger cars. No temporary roads would be built under alternative 3, so there would be no effects.

Construction of these roads and the decommissioning of these roads will be defined in detail by contract specifications with the objective of minimizing impacts to soil and water, wildlife, recreation and cultural resources.

Gravel Pits

The sites for the gravel pits have not yet been located, but they will likely be on the western side of the project area. The rock in that area is of good enough quality to use on the roads. The pumice rock found along Forest Road 10 is not good for road work because it breaks apart easily.

Effects from the construction of gravel pits and access roads include dust, noise, and ground disturbance, displacement of wildlife, changes to natural drainage patterns, and changes in the visual landscape. Ground disturbance is the most serious. Each pit would be up to 5 acres in size and would have an access road. Vegetation would be cleared from the site, and surface dirt would be removed from the rock source. Using gravel from Forest Service gravel pits would allow us to provide a better road surface, and we could do more miles of road maintenance for less cost. We could also improve more miles of road. The improved road surfaces would result in fewer impacts on soil and water resources. Surfacing the roads with gravel would reduce the need for future maintenance, and would reduce adverse effects on water quality for a longer time.

Explosives would be used to break up the rock, and the blasting would generate noise and dust for a short period of time. The blast itself would create noise lasting a short time. Rock crushers would also create noise and dust.

Figure 39.Gravel doesn't last forever. To keep gravel roads in good condition we need to regularly replace the gravel as we're doing with this road.

The noise would disturb wildlife as well as any forest visitors in the area. Effects from noise and dust would be short term, localized, and minor, as discussed previously. Because these gravel pits are not commercial gravel pits, the rock blasting and crushing would happen on an irregular, as-needed basis.

Blasting and crushing would affect public safety, but these would be minimized by the design features. The roads to the gravel pits would be adequate for construction equipment, but not passenger cars. Access roads to the pits would not be maintained in good condition to discourage public use. Access roads would not be open to the public.

Gravel pits would not compete with commercial gravel pits in the area. Our gravel pits are intended for use on the forest only. They would also be small and because of their remote locations, hauling to and from the pits would be inconvenient for new commercial operators.

The effects of constructing gravel pits and access roads on other resources are discussed throughout this chapter.

Alternative 2

Under the no action alternative, we would not build any gravel pits or access roads, or temporary roads. We would not decommission roads, other than the 2 miles with approved NEPA decisions. The remaining roads would continue to deteriorate and have adverse effects on water quality and cultural resource sites. We would continue to do road maintenance within the project area, although fewer miles would be maintained than under the action alternatives (see table x). This maintenance would have the same noise and dust effects we described earlier in this section. Road use and traffic would be about the same as it is currently.

Alternative 3

The effects from increased road use, road maintenance, opening of roads, and gravel pits would be the same as those described for alternatives 1, 4, and 5. Impacts from roads would be slightly higher because fewer miles of road would be maintained and fewer miles of road would be re-opened (see table x). There would be no effects from temporary roads because they would not be built under this alternative.

Cumulative Effects

Roads closed with the implementation of the forest travel management decision along with the roads closed after treatments are finished would reduce open road density. The forest designated motor vehicle use on the forest and traffic did not change.

Conclusion of Effects

In this section, we answer the analysis questions to see how well the road activities address the issues, concerns, and purpose and need.

What are the effects of increased traffic on the human environment?

- There would be increases in noise, dust, and traffic along forest roads from project vehicles, road treatments, and heavy trucks. These are effects would be localized and temporary.

Would impacts from roads on the environment be reduced by the road treatments?

- Yes. Decommissioning roads would have the greatest impact. The roads we selected for decommissioning were prioritized by the impacts they have on wildlife and habitat, water quality, and cultural resources. We would decommission the worst roads first. If we don't decommission the entire amount of roads we hope to do, we would still reduce impacts on these important resources.
- Maintenance and road surfacing with rock provided by the rock pits would also reduce road-related impacts on water quality.
- What are the effects on the environment of opening roads and building temporary roads?
- See the other resource sections of this chapter for more information on the extent of effects from temporary roads on soil and water resources, cultural resources, and wildlife. Effects from opening roads and building of temporary roads include small increases in dust, and noise. Effects are limited because temporary roads would be decommissioned after use and the re-opened roads would be closed.

Scenery

The scenery specialist report (Bueno 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations.

Affected Environment

The landscape character describes the aesthetic, social and biophysical features that give the place its identity. The Jemez Mountains have a variety of dramatic landscapes from meadows and deep valleys to sheer cliffs with breathtaking views. The scenic character is a natural-appearing landscape of mountains with rounded and smoothed crests, flat-topped mesas, and steep canyons. Elevations range from 5,500 feet in the valleys to 10,109 feet at the top of Cerro Pelado. Landslides and exposed rock formations are common features. Geologic activity continues to change the landscape.

Ponderosa pine and dry mixed conifer forests dominate the lower mountain slopes. Wet mixed conifer and spruce-fir forests are found on the upper mountain slopes. Aspen and mountain meadow grasslands are also found here. Piñon-juniper woodland, riparian, sagebrush and chamisa (rabbitbrush) dominate the lower elevations.

The area has several moderately-sized perennial (year-round) streams and rivers. The Jemez River flows through the middle of the project area. Other waterways include San Antonio Creek, Rio Guadalupe, and Rio Cebolla. The wet meadows found within the project area are also highly valued scenery attributes.

The Jemez Mountains are highly valued for scenery and recreation. There are numerous meadow corridors, areas that are typically considered rare and treasured landscapes in New Mexico. The East Fork of the Jemez River is a nationally designated Wild and Scenic River with outstanding and remarkable scenery. Hot and warm springs are found throughout the Jemez Mountains and are popular cultural and recreation destinations.

Currently, there are limited views and little vegetative diversity because of the dense, even-aged, forests with closed canopies. The forests have lost their diversity because of past logging and fire suppression. There are too many small and mid-size trees and not enough mature and old-growth trees and a sparse surface cover of grass. There are fewer aspen groves and mountain meadows as a result of fire suppression.

The current landscape has a very low scenic stability or resilience to changes caused by ecological disturbances or stressors. These stressors include drought, increased stand density, uncharacteristically severe wildfire, and intensive recreational use. Some of the main scenery features such as the mountains, mesas, and canyons are likely to be unchanged by stressors. Other features, including large trees, meadows, and forests, may be seriously affected.

The existing scenic integrity[22], the intactness or completeness of the landscape, as seen from the most sensitive areas ranges from moderate to high. The scenic character has changed from its historical condition, but the changes are not generally noticed by most visitors. Within the Jemez National Recreation Area (NRA, Management Area X), the existing scenic integrity ranges from moderate to high. Outside of the Jemez NRA, the existing scenic integrity tends to match the Visual Quality Objectives levels in the forest plan. Figure 40 shows these VQO and SIO levels within the project area.

Methods Used to Analyze Effects

The visibility of the effects from the proposed action and the alternatives were determined using field visits, photos, geographical information system (GIS) data, digital elevation models (DEMs) from the Santa Fe National Forest and Google Earth, and simulations in Adobe Photoshop and Illustrator. A visual inventory was conducted by a landscape architect specializing in visual resources assessment. The visual inventory identified key viewpoints, sensitive areas viewsheds, and their sensitivity or concern levels.

[22] Scenic integrity is a measure of visual quality. It is the degree to which the landscape is seen by the viewer as complete. Landscapes with a high scenic integrity have all or most of the landscape features valued by people who live in and/or use the area.

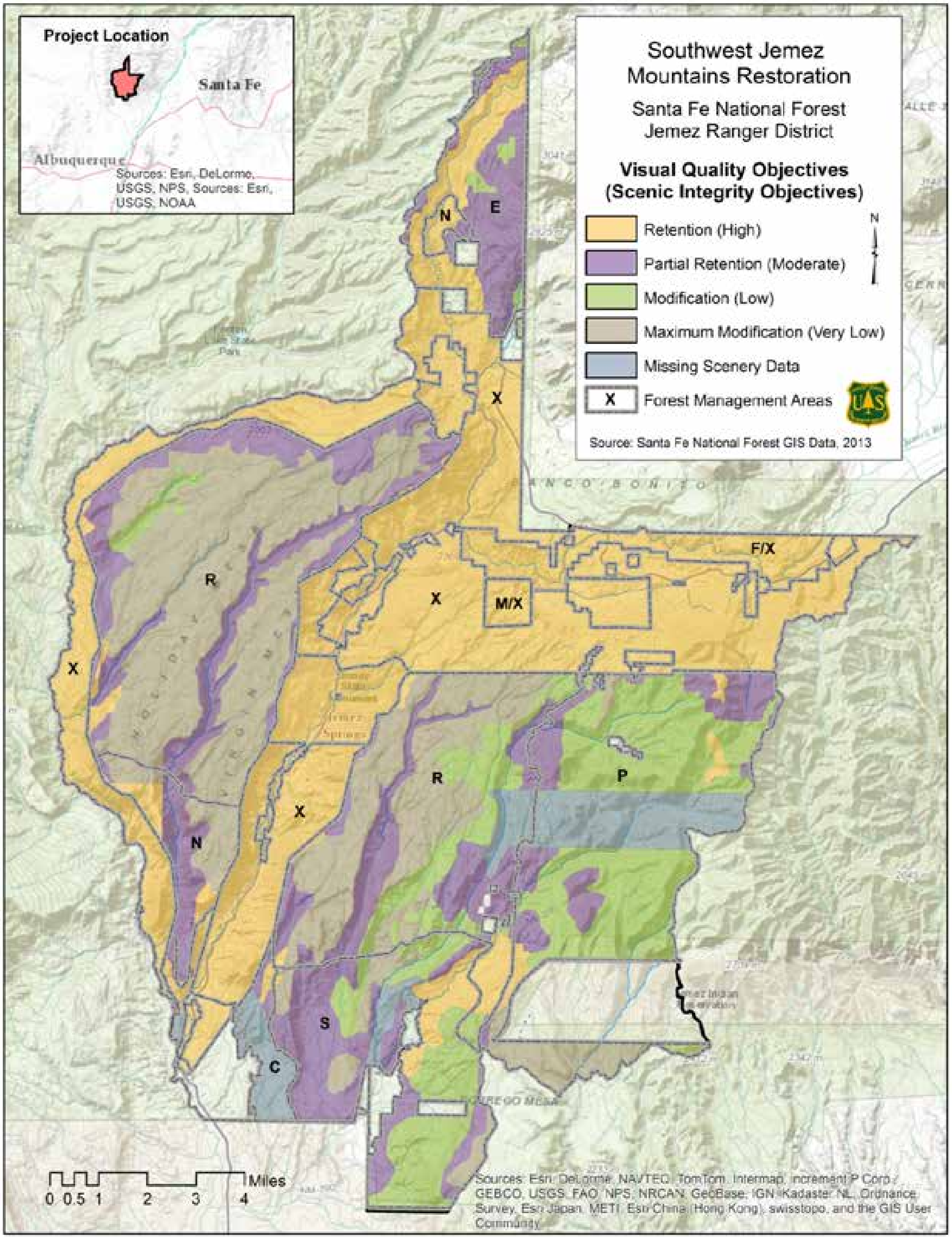

Figure 40. Visual Quality Objective and Scenic Integrity Objectives levels in the project area. Scenic Integrity Objectives apply level to the Jemez National Recreation Area; an SIO level of High has been established for this area. Visual Quality Objectives apply to the rest of the area.

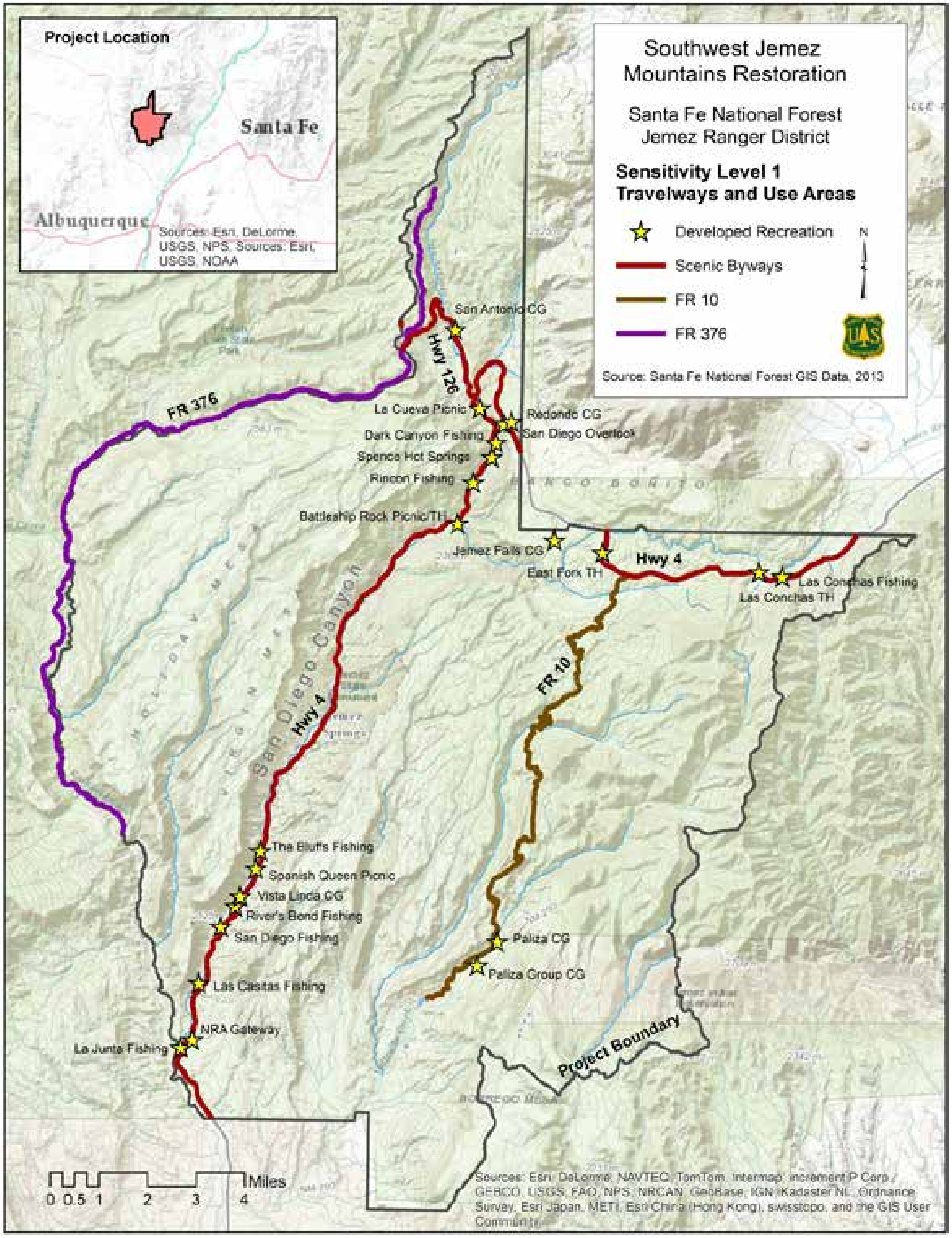

Figure 41. Sensitivity Level 1 areas, travelways and use areas are located along highways and major forest roads.

Sensitivity or concern levels measure the degree of public importance placed on views of the landscape (figure 41). There are three levels of sensitivity, and level 1 is the most important. It is associated with major roads, trails and areas of concentrated use, where users have a high degree of concern for scenery. Levels 2 and 3 are of progressively lesser importance. Views from the National Scenic Byway (State Highways 4 and 126), views from developed recreation areas within the Jemez National Recreation Area, views from concentrated recreation corridors (FR 10 and FR 376) and views from access points within the South Fork Jemez Wild and Scenic River corridor are all Level 1 areas. These will be referred to as sensitive areas. Key viewpoints were chosen as representative views from these sensitive areas. The effects on scenery are analyzed from the viewpoints. There are 17 key viewpoints; most of them are located along Highway 4 and Highway 126. Others are located along Forest Roads 10 and 376. A map and table of the key viewpoints is found in the scenery specialist report.

The forest plan was written when scenery was managed under the Visual Management System (VMS) (USFS 1974). Forestwide Visual Quality Objectives (VQOs) were established in the plan. The Jemez NRA and the Jemez Wild and Scenic River management plans use the updated Scenery Management System (SMS) which establishes Scenic Integrity Objectives (SIOs). The forest plan has not been revised to reflect this change. To stay consistent with the forest plan, the term VQO is used throughout this report. Visual quality and scenic integrity are measured by levels that describe the degree to which the landscape appears intact, complete and natural. The levels of each system are generally used interchangeably, including in this analysis.

All areas within the Jemez NRA have an MSI level of High, including the Monument Canyon Research Natural Area and The East Fork Jemez Wild and Scenic River (see figure 42). Other locations with a High level are the Paliza Campground area in Management Areas S and R, and the San Antonio River area within Management Areas E and N. Other areas within the project boundary along drainages and slopes popular for dispersed recreation have an MSI of Moderate.

The more remote areas to the east have an MSI of Low and the mesa tops, which are screened from most middle and background views, have an MSI of Very Low. Areas that don’t have scenery data were treated similarly to adjacent lands. The SMS also introduced a new indicator called Scenic Stability. Scenic Stability measures the degree to which scenery can be sustained through time for future generations. It considers the current condition of valued scenery attributes and identifies whether or not their condition is at risk. The valued scenery attributes and their current risk levels are described below:

- Ponderosa pine and mixed conifer forests that have an open appearance, with a mosaic of interspaces and openings, and consist of groups of tree of varying ages, shapes and sizes. This scenery attribute is at high risk.
- Large diameter, old-growth ponderosa pine and mixed conifer trees are well-represented throughout the project area. This scenery attribute is at high risk.
- The forest demonstrates resiliency by having frequent, low-intensity fires occur without becoming uncharacteristically severe wildfires, and an open characteristic that limits mortality from pests and disease. This scenery attribute is at high risk.
- Long views from vista points overlook dramatic topography, scenic rock outcroppings, and a high diversity of distinctive landscape features. This scenery attribute is at moderate risk.

- Perennial waterways, waterfalls, springs and seeps are considered rare and treasured landscapes in the high desert, and they are free-flowing with limited turbidity. This scenery attribute is at moderate risk.
- Aspen stands and Gambel oak are commonly found in a healthy, diverse and resilient forest understory. This scenery attribute is at high risk.
- Open meadows and grasslands provide an important contrast to the forested landscape. This scenery attribute is at moderate risk.
- Dramatic topography includes rocky outcroppings, deep canyons, steep slopes, and flat-topped mesas. This scenery attribute is at very low risk.
- Geothermal activity in the form of hot springs, warm springs and locations of intense mineral deposits. This scenery attribute is at very low risk.

The following indicators were used to measure the effects on scenery: (1) a description of changes to the natural landscape character, (2) scenic integrity; the changes in the degree of apparent scenery intactness, and (3) scenic stability; the changes in the sustainability of scenery attributes over time. Activities that lead to change from the natural landscape character, adversely impacting scenic integrity, would have a negative effect. Activities that do not change the landscape character would have a neutral effect. Activities that enhance scenery and fully express the landscape character, such as the opening of vistas and the reduction of undergrowth to improve depth of view into the forest, would have a beneficial effect. Short-term effects are those that last 1-5 years after implementation. Long-term effects are those that last 5-25 years after implementation.

Analysis Questions

The analysis questions were derived from the purpose and need and the issues that arose during scoping as described in Chapter 1. The purpose and need does not address scenery, but restoring ecosystems and increasing resiliency would benefit the scenic quality in the area. There were no scoping comments specific to scenery, but it was indirectly addressed in some of the comments about the scale of the mechanical treatments. People expressed concern that the forest landscape would change drastically and resemble a meadow. Others wanted more large trees on the landscape, mainly for wildlife habitat. Responses to these and related topics are in the scoping report in the project record.

The relevant analysis questions are:

- Would there be negative effects on scenery, and to what extent would the landscape be free from visible disturbances during implementation of the project?
- Would the scenic stability, especially of the forested landscape, be maintained?

Summary of Effects

Under alternatives 1, 3 and 4, there would be short-term, negative effects on scenery from mechanical treatments and prescribed fire. The effects include:

Mechanical treatments:

- Sights of slash, stumps, ground disturbance, woody debris piles, and skid trails

- Temporary roads created during implementation would insert new, unnatural-appearing lines into the landscape on a temporary basis
- Trees would be removed, soil exposed, and roadbeds constructed
- Existing vegetative screening of management activities or other disturbances such as roads would be decreased or eliminated

Prescribed fire:

- Burn scars, a blackened understory, burnt soil, and dead and dying vegetation from low intensity prescribed fire.
- Low intensity smoke, causing a temporary lack of visibility and obscuring of scenery. This type of smoke only occurs for the duration of the burn and dissipates into the atmosphere, as opposed to smoke from a high-intensity wildfire, which can heavily impact air quality and landscape visibility for weeks and months.

Fence Exclosures:

- Fencing would introduce unnatural linear features into the landscape that would not be natural-appearing.

The effects from mechanical treatments would be most visible from the foreground (300 feet to 1/2 mile) and middleground (1/2 to 4 miles) views. Steep topography would hide the effects when viewed from sensitive areas in valleys and canyon bottoms, but would highlight effects in middleground distances when seen from vista points and overlooks. Fence exclosures would be temporary and negative effects on scenery would be greatly reduced by following the design criteria and mitigation measures.

The long-term effects on scenery would be beneficial. Having a more open tree canopy would improve the views into the forest and the views to the horizon. The diversity of species, texture, color and form would be increased, adding to the level of scenic integrity. While the area would appear quite open compared to current views, the area would maintain its forested character, and would not resemble a meadow.

Treatments would improve the scenic stability of the area because the landscape would be more resilient to wildfire, disease and drought. The high level of stability would ensure that the scenic integrity would be preserved over time.

The long and short-term effects of alternatives 3 and 4 are very similar to those of alternative 1, with some differences. Under alternative 3, there would be no effects from the construction of temporary roads and fewer effects associated with mechanical treatments. Under alternative 4, there would be fewer effects from prescribed fire treatments, but more negative effects from the sight of slash and woody debris. Under both alternatives, the potential for a severe wildfire would increase because of higher fuel loads in untreated areas. A severe fire would have long-term negative impacts on scenery.

Design criteria and mitigation measures in appendix A would help to minimize the short-term, negative effects of the treatments for all alternatives 1, 3, and 4.

Under alternative 2, most of these treatments would result in minimal improvements in scenic integrity and stability. Scenic stability and integrity would decline as ecosystem conditions decline, and the area would not meet forest plan scenery guidelines.

Environmental Consequences

Alternative 1

The main treatments proposed are mechanical treatments and prescribed fire. These treatments would have short-term negative effects during and immediately following implementation:

Scenic integrity in Sensitivity Level 1 areas would be negatively impacted during and immediately following implementation. The short-term visibility of effects in foreground[23] and middleground views as seen from these areas would be temporary. The lack of detail visible in background views would allow the effects on visually blend into the landscape when seen from this distance. Steep topography would screen effects from treatments when viewed from sensitive areas in valleys and canyon bottoms.

Some key viewpoints are vista points with middleground views towards areas of potential mechanical treatments. Treatments along slopes at middleground distances can be more visible and would reduce the scenic integrity. Overall, the short-term visibility of effects from Sensitivity Level 1 areas would be kept to a minimum with use of the design criteria and mitigation measures (appendix A).

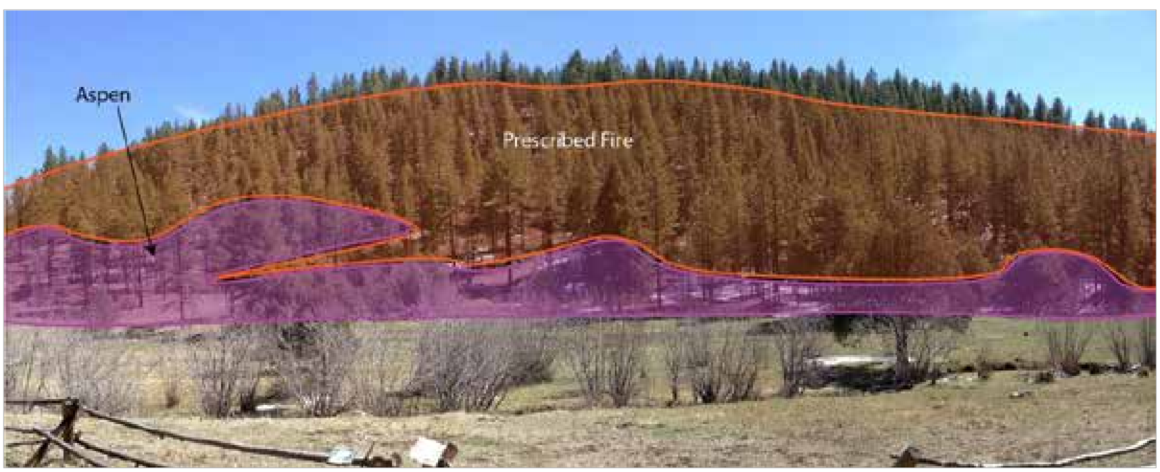

Figure 42. Representative view of prescribed fire and aspen treatments from Key Viewpoint D, along Forest Road 376. This viewpoint represents open views of meadow, aspen and prescribed fire treatments along a sensitive dispersed recreation corridor. Existing scenic integrity is High. Short-term effects would lower scenic integrity to Moderate during and immediately following implementation. Long-term effects would enhance the valued landscape attributes and restore the scenic integrity to meet or exceed the scenic integrity level of High.

[23] Distance zones are measured from key viewpoints and are divided into categories: Immediate Foreground (0 to 300 feet); Foreground (300 feet to ½ mile); Middleground (½ to 4 miles); and Background (4 miles to the horizon).

Long-term effects would be beneficial to scenery, both aesthetically and ecologically. The proposed mechanical and prescribed fire treatments would have the immediate and long-term effect of opening the tree canopy and improving the depth of view into the forest and views to the horizon. Research has shown that viewers prefer forests that are more open and allow views through them to forests with dense vegetation (Ryan 2005). The current vegetative screening provided by the dense forests would be reduced, understory vegetation is expected to fill in and provide some screening over time.

Treatments could be planned to enhance scenery by opening and/or framing vistas. Management activities that are screened by dense vegetation would become more visible. Vegetative screening in dispersed recreation areas may decrease in the short term, but may actually improve over time as new understory vegetation grows into the area. Other long-term effects include increases in the landscape's visual diversity because of age and species diversity in the vegetation.

Overall, the proposed treatments would improve the landscape's scenic integrity. Ecologically, the treatments would increase the landscape's resilience to wildfire, disease and drought, improving the level of scenic stability. The trend toward a high level of stability would ensure that the scenic integrity would be preserved over time.

Alternative 2

There are a few prescribed fire and mechanical treatments projects currently approved. Most of these treatments would result in minimal improvements in scenic integrity and stability, but these improvements would not be visible from sensitive areas. Untreated areas would remain at the existing scenic integrity level. As the risk of insect and disease outbreaks and uncharacteristically severe wildfire increases, scenic stability would decline. This decline would continue over the long term due to the lack of visual diversity, meadow encroachment, screening of vistas, and increased risk of uncharacteristically severe wildfire. A decrease in scenic integrity would not meet forest plan guidelines.

Alternative 3

The effects from alternative 3 would be very similar to those of alternative 1. The main difference is that temporary roads would not be built. About 1,900 acres would not be mechanically treated, and would be treated with prescribed fire only.

This would reduce the short-term negative impacts from the use of heavy machinery in the areas that aren't mechanically treated such as scarring of trees, creating direct views into skid trails and landings from sensitive areas, and views of slash piles, soil disturbance and compaction. There would be no need to rehabilitate the landscape after decommissioning a temporary road. If a severe wildfire burned on the area that is not mechanically treated, there would be long-term, negative impacts on scenery.

Alternative 4

The effects from alternative 4 are also similar to those of alternative 1, except that mechanically treated areas would not be treated with prescribed fire. Reducing the use of prescribed fire would primarily affect immediate foreground and foreground views. The sight of smoke, haze, and blackened trunks and soil associated with burning would be reduced. The short-term, negative effects caused by prescribed fire would be slightly reduced, but these reductions would be negligible because of the extent of prescribed fire in the project area.

The visibility of scattered slash and woody debris would increase. Scattered woody debris is generally less noticeable to the casual observer than the dark scars left following a burn, particularly when viewed from middleground and background distances. From these distances, the negative effects of scattered woody debris would be negligible.

When viewed from foreground distances, slash and scattered woody debris are obvious to the casual observer and appear unnatural. The woody debris detracts from scenic integrity until it decomposes. This would cause a negative effect on scenic integrity. If a wildfire burned in the area that was mechanically treated, there would be long-term, negative impacts on scenery.

Alternative 5

The effects from alternative 5 would be very similar to those of alternative 1. Under alternative 5, prescribed fire would not be used in core areas of protected activity centers, and fire control lines would be built to keep prescribed fire out of the core areas. The bulk of the core areas would be located outside of sensitive viewsheds and therefore, control lines would generally not be visible. Control lines around the core areas would be visible from some foreground distances, but because hand-cut lines tend to follow existing breaks and the natural contours of the landscape, they would remain subordinate to the overall landscape character being viewed. In middleground distances, control lines would be far enough away to not be evident to the casual observer.

Two core areas would fall within the viewsheds of sensitive recreation corridors. Under this alternative, the short-term, negative effects caused by prescribed fire would be slightly reduced because fewer acres (700) would be burned. These reductions would be negligible because of the extent of prescribed fire in the surrounding project area. The intensity and duration of effects would be the same as those described for prescribed fire under alternative 1. Other short and long-term effects would be similar to those described in Alternative 1.

Forest Plan Amendments

The amendments regarding vegetation treatments in Mexican spotted owl habitat would have a long-term beneficial effect on scenery because limited treatment in those areas would help trend the entire landscape towards the desired conditions for vegetation, fully expressing the natural landscape character.

The amendments related to interspaces in goshawk habitat, conducting surveys in peregrine falcon areas, allowing activities to occur during wildlife breeding seasons, and those related to scenery would have positive effects because more of the forest would be treated in a shorter time period. Reducing tree density would have the immediate and long-term effect of opening the tree canopy and improving the depth of view into the forest and views to the horizon.

Cumulative Effects

Cumulative effects are the impacts resulting from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions. The cumulative effects analysis for all alternatives includes projects located within the project boundary. Cumulative effects include those from prescribed fire and mechanical treatments in and around recreation destinations and the construction of parking facilities and fences for resource protection (see appendix B).

The cumulative effects for all alternatives (1, 2, 3, and 4) are very similar. The prescribed fire projects and most of the thinning projects either would complement the proposed action or are not visible from Sensitivity Level 1 areas, indicating that there would be no negative cumulative change to scenery. Two thinning projects, Vallecitos and Banco Bonito, are adjacent to the project area and would increase short-term impacts from mechanical treatments. However, the long-term effects from both would visually enhance the landscape character while improving the scenic stability of the area and increasing the long-term resilience of the forest.

Cumulative effects of existing fence exclosures are short term, and would benefit scenery over the long term by increasing species diversity through the protection of young and delicate meadow vegetation from domestic and wild herbivores and overuse by visitors. Short term, negative effects would be minimized if the exclosure projects followed the design criteria and mitigation guidelines included in the proposed action. Two parking areas were built in high use areas, and both benefit scenery by minimizing the visual impact of cars seen parked along roads and, thus improving views of scenery.

Conclusions About the Effects

Would there be negative effects on scenery, and to what extent would the landscape be free from visible disturbances during implementation of the project?

- There would be negative effects on scenery from the restoration treatments. The mechanical treatments and prescribed fire would have the most visual effects. These effects would be short term and would be more noticeable at closer distances. Visitors would see temporary signs of disturbance such as tree stumps, skid trails, machinery, and bare or blackened soil. Design criteria and mitigation measures were developed to minimize these short-term negative effects, as the landscape transitions to be more open, scenic and ecologically sound. Treatments areas would shift over time, and effects would fade as time passes. Also, some areas would be closed while mechanical treatments are occurring and visitors would not experience the immediate impacts of treatments. Most of the prescribed fire would take place in the fall, and fewer visitors would see or experience the immediate effects. New understory plant growth in the spring would cover some of the burn effects, such as blackened soil.

Would the scenic character and stability, especially of the forested landscape, be maintained?

- The scenic character and stability of the forests and other landscape features would be maintained over time. The topographic features- mountains, canyons, mesas- would not change. Other features of the scenic character would improve and the landscape would have more of its natural character. There would be more large trees and more aspen groves. Meadows and grasslands would provide an important contrast to the forested landscape. Understory grasses and flowering plants would also add diversity. Streams and riparian areas would appear more natural because there would be fewer campsites, less trash, and fewer areas of bare dirt. Streams would have less sediment and the water would be clearer.
- The treatments would increase resiliency of the landscape to wildfire, disease and drought; the forests would not be lost to a severe wildfire. This would improve the scenic stability and character. The high level of stability would ensure that the scenic integrity would be preserved over time.

Social Science, Economics, and Environmental Justice

The socioeconomic and environmental justice specialist report (Cohn 2013) and the economic analysis report (Dobb 2013) are incorporated by reference. See the reports for detailed information on data sources, methodology, assumptions, and limitations.

Affected Environment

Demographic and economic data used in this section were obtained from the 2010 U.S. Census and also generated from the Economic Profile System-Human Dimensions Toolkit (Headwaters Economics 2011).

The Southwest Jemez Mountains Restoration project area is entirely within Sandoval County. The local area for the analysis includes Sandoval, Los Alamos, Bernalillo, and Santa Fe Counties. Sandoval County is the focus of the analysis. The other counties are included because they are close to the project area and have interested stakeholders. The communities nearest the project area are Jemez Pueblo, Jemez Springs Village, Cañon, Ponderosa, Thompson Ridge, and Sierra los Pinos. Jemez Pueblo is a federally recognized tribe and sovereign nation. Nearby cities are Los Alamos, Santa Fe, Rio Rancho, and Albuquerque.

Jemez Springs, closest to the project area, is ‘rural residential and agricultural’, and most residents commute outside the area for work (Sandoval County 2008). The town has many small businesses that service the small communities in the Jemez Valley. The Jemez Pueblo and several other pueblo communities in the area have used the Southwest Jemez Mountains for many generations and have a deep spiritual connection to the land. The local pueblos rely on the water, wildlife, and vegetation resources for sustenance, including hunting and plant gathering.

About 34 percent of Sandoval County land ownership is tribal land, 42 percent is federal government, 21 percent private, and 3 percent state government land. The Navajo Nation, Jicarilla Apache tribes, and nine pueblos own land in the county (Sandoval County 2008). Within the project boundary, there are 9,710 acres of private land, 281 acres of state land, and 3,485 acres of Jemez Pueblo land.

What is now the national forest has a long history of resource use including farming, subsistence use, mining, logging, and grazing. Use of the forest has shifted from subsistence and commercial uses to recreation, wildlife watching, and other non-consumptive uses. Recognition and appreciation of the ecosystem services provided by the forest is increasing. People are aware of how the forest benefits and enhances the quality of life for individuals and the community (Russell and Adams-Russell 2006).

Population

The population of Sandoval County in 2010 was 131,561, an increase of 46.3 percent since the 2000 census, making it the fastest growing county in the state. The average population growth in the state for the same period was 13.2 percent (U.S. Census 2010). Population of the nearby communities is: Jemez Pueblo- 1,788; Jemez Springs Village, 250; and Ponderosa, 387. Jemez Pueblo and Jemez Springs Village have declined in population since the 2000 census.

Income and Employment

Within Sandoval County, economic and employment statistics are quite variable. The median income is $57,158; more than $15,000 higher than the state figure. Median income levels for nearby communities are also higher than the statewide average (U.S. Census 2012).

Most jobs in Sandoval County are in government (19.4 percent), manufacturing (10.7 percent), and retail sectors (10.3 percent) (Headwaters Economics 2012). Natural resource-related jobs are less than 1 percent of the total jobs. Most of the timber jobs are in wood products manufacturing. Jemez Springs and Jemez Pueblo show 5 and 12 jobs respectively in natural resource fields (ACS 2007-2011). The few natural resource jobs are important to local residents as these jobs contribute to a traditional and cultural way of life (Raish et al. 2003). As resource-dependent jobs have declined, service-oriented jobs in retail, travel, and tourism have become more important to residents in this area. The number of tourism jobs in Sandoval County has increased from approximately 3,115 jobs in 1998 to 4, 815 jobs in 2010. A few of those jobs, 17, are in Jemez Springs (U.S. Census 2012). This is a drop from 40 jobs before the recent recession started in 2007.

Environmental Justice

Environmental justice is 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, and policies. The goal of environmental justice is for agency decision-makers to identify impacts that are disproportionately high and adverse with respect to minority and low-income populations and identify alternatives that will avoid or mitigate those impacts (USDA 1997). Race and ethnicity in the affected counties and the state is shown in table 22.

Table 22. Population by race and ethnicity, 2011

	New Mexico	Los Alamos County	Sandoval County	Santa Fe County	Bernalillo County	U.S.
White	72.0%	88.1%	70.5%	83.1%	69.8%	74.1%
African American	2.0%	0.5%	2.8%	0.8%	2.8%	12.5%
American Indian	9.3%	0.4%	12.9%	3.0%	4.6%	0.8%
Asian	1.3%	5.1%	1.3%	1.2%	2.3%	4.7%
Other races	15.4	5.9	12.5	12.0	20.5	7.8
Hispanic (any race)	45.9%	14.5%	34.8%	50.4%	47.3%	16.1%

In Sandoval County, whites are 70.5 percent of the population, nearly equal to the statewide figure of 72 percent. The Native American population comprises 12.9 percent of the county, again, higher than the state figure. Hispanics[24] make up 34.8 percent of the Sandoval County population, lower than the statewide figure of 45.9 percent. Combined, Hispanic and Native

[24] *Hispanic* or *Latino* refers to a cultural identification, such as Mexican, Puerto Rican, or Spanish; it is not race (U.S. Census 2011). Hispanics can be of any race and are not included as a separate category in the race distribution.

Americans are over 50 percent of Bernalillo and Santa Fe Counties. At the community level, American Indians make up, as expected, nearly 100 percent of the Jemez Pueblo population. The Hispanic population in Jemez Springs Village and Ponderosa are near or above the percentage for Sandoval County.

The percentage of people below the poverty level in Sandoval County is 15.1 percent. The statewide figure is 20.4 percent (U.S. Census 2012). In New Mexico, poverty is linked with race and ethnicity (Sierra 2004), and county level poverty figures vary by race or ethnicity. The percentage of people below poverty level in Jemez Pueblo is 15.3 percent; in Sandoval County, 23 percent of American Indians live below the poverty level, somewhat lower than the statewide figure of 31.5 percent. In Sandoval County, 13.5 percent of Hispanics are below the poverty level (U.S. Census 2012). These county level poverty percentages for Hispanics and American Indians are consistent with state and national figures, but slightly higher than that for Sandoval County (U.S. Census 2012).

Based on the minority status and poverty level figures presented above, Sandoval County appears most at risk for environmental justice issues.

Methods Used to Analyze Effects

The economic impacts of the project on the area’s employment, production, income and natural resource base were calculated using IMPLAN (IMpact analysis for PLANning). Quick-Silver Version 7 was used for the cost-benefit analysis. Data on use and production for each alternative were provided by the resource specialists from the Santa Fe National Forest. Changes in use were based on their professional expertise. Social impacts were analyzed using the information on social and demographic conditions in the Affected Environment section and the Santa Fe National Forest Economic and Social Sustainability Assessments (Russell and Adams-Russell 2006; BBER 2007). Quality of life factors that may be affected by the treatments were identified through public involvement.

Analysis Questions

The analysis questions were derived from the purpose and need and the issues that arose during public involvement. Part of the purpose and need is to “offset treatment costs and provide economic opportunity” by providing a “source of wood products for commercial and personal use.” The relevant issues are (1) the economic effects of smoke from prescribed fires, and (2) the effects of smoke on minority and/or low-income communities.

- Would the smoke from prescribed fires affect minority and/or low-income communities disproportionately?
- What are the costs associated with avoiding or treating the adverse health effects of smoke from prescribed fires?
- To what extent would the sale of wood products offset costs of the restoration treatments?
- What type and amount of economic opportunity, including employment, would be created?
- What type and amount of wood products would be generated?

Summary of Effects

Impacts from smoke would occur under any alternative, including the no action alternative. Costs associated with avoiding smoke or treating adverse health effects from prescribed fire smoke are likely to be higher under alternatives 1, 3 and 5 than under alternatives 2 and 4. Economic impacts from a severe wildfire would be highest under alternative 2.

Alternatives 1, 3, 4, and 5 are estimated to support similar numbers of jobs and similar amounts of total labor income (table 23). Nonmarket and social benefits (resiliency, reduced wildfire risk, ecosystem services wildlife habitat, scenic and recreational values, etc.) would be similar under alternatives 1, 3 and 5. There would be fewer of these benefits under alternative 4 because there is less prescribed fire and least under alternative 2 because a smaller area is treated. The amount and type of wood products for commercial and personal use would be about the same under alternatives 1, 3, 4, and 5 and substantially less under alternative 2 (no action). Alternatives 1, 3, and 5 have similar costs to the government; costs are lowest under alternative 4. The relatively small differences in jobs, labor income, and costs are due to the amount of acres treated by prescribed fire and potential, temporary restrictions on grazing.

Table 23. Estimated annual amount of total jobs and labor income

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Jobs	229-249	164-181	226-246	218-237	229-252
Labor income in thousands of dollars	$6,073 - $6,614	$4,040 - $4,550	$5,982-$6,523	$5,865 - $6,406	$6,073-$6,076

Negative, short to medium term impacts to grazing permittees would occur under alternatives 1, 3, 4, and 5 in the form of reduced grazing opportunities and higher costs associated with grazing. Over the long term (greater than 5 years) there would be positive impacts as forage quality and quantity increases because of more open forest conditions. There are potential long-term negative impacts under alternative 2 as the forest canopy becomes denser and forage quantity and quality decrease and the risk of a severe wildfire increases.

There is a high potential for adverse impacts from smoke on the county and communities most at risk for environmental justice issues: Sandoval County, Jemez Springs, Jemez Pueblo, Cañon, and Ponderosa under all alternatives. These impacts are not disproportionate because they are an unavoidable consequence created by the geographic location of the communities. Beneficial impacts exist under all action alternatives: (1) jobs; (2) wood products for personal use; and (3) restoration of forests and protection of cultural sites. These benefits would be much less under alternative 2, especially for jobs, because less area is treated.

Environmental Consequences

Economic and social effects on tribal and at-risk communities are discussed in the Environmental Justice section.

Economic Effects - Alternatives 1, 3, 4, and 5

Economic impact analysis measures how project activities would affect employment, income, and economic activity in the regional economy. Employment and labor income generated annually by each alternative are displayed in tables 18 and 19. Alternative 2 is used as the baseline and represents the current condition. Alternatives 1, 3, 4, and 5 show a temporary reduction of jobs and income because grazing is reduced after prescribed fire treatments. There is an increase in employment and income generated by increased harvesting and wood processing activities.

Table 24. Estimated annual number of jobs created annually for each alternative. Alternatives 1, 3, 4, and 5 create about the same number of total jobs.

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Recreation	116-133	116-133	116-133	116-133	116-133
Grazing	31-34	38	31-34	32-34	31-34
Timber	30	1	27	29	30-33
Restoration Treatments	52	8	51	41	52
Total Contribution	229-249	164–181	226–246	218-237	229-252

Table 25. Estimated amount of labor income by resource for each alternative, in thousands of dollars. Alternatives 1, 3, 4, and 5 generate about the same amount of labor income.

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Recreation	$3,540 - $4,050	$3,540 - $4,050	$3,540-$4,050	$3,540 - $4,050	$3,540-$4,050
Grazing	$248 - $279	$310	$248 - $279	$248 - $279	$248-$279
Timber	$993	$31	$917	$993	$1,055
Restoration Treatment	$1,292	$159	$1,277	$1,064	$1, 094
Total Income	$6,073 - $6,614	$4,040 - $4,550	$5,982-$6,523	$5,865 - $6,406	$5,937-$6, 478

The mechanical treatments and prescribed fire treatments are expected to have negative effects on recreation quality and the number of visits (see recreation section of this chapter). Overall, visitation is expected to stay the same over the life of the project. Visitors to the project area support an estimated 116-133 jobs and $3.5 and $4 million in labor income annually in the local economy. This contribution is not expected to change under any of the alternatives.

Rangeland Resources

Grazing activities currently support an estimated 38 jobs and $310,000 in labor income annually. Under alternatives 1, 3, 4, and 5 there are fewer jobs and less income from grazing. This is because authorized livestock numbers and/or season of use would be reduced for 1-2 seasons to allow vegetation to recover after prescribed fire treatments. The reductions are temporary. At the end of the project, grazing levels would return to pre-project levels, and jobs and income are also expected to recover.

The reduction in grazing is a short-term impact. Permittees would have time to adapt to the changes. To reduce impacts on permitees, prescribed fire would not be used on all the pastures in an allotment at the same time, and permittees could move livestock to the untreated pasture. Some permittees may incur additional expenses including the purchase of private forage or pasture or transportation costs, and those with a few head of livestock would be impacted more.

Over the long term, improved ecosystem conditions would improve forage quality and quantity and ranching viability. Such increases in grasses and forbs after prescribed fire and thinning have been well-documented (Arnold 1950; Covington et al. 1997; Laughlin et al. 2006; Bartuszevige and Kennedy 2009; McIver et al. 2012). Permittees and the Forest Service may also benefit from reduced administrative and management costs.

Other Restoration Treatments

These treatments include prescribed fire, meadow restoration, headcut treatments, wildlife habitat improvement, and so on. Under alternatives 1, 3 and 5, about 50 jobs would be created, resulting in nearly 1.3 million dollars in labor income. These amounts are slightly less under alternative 4 because less prescribed fire is used. No increases in employment or income are expected if this work is done by Forest Service employees. There would be some small benefit to local communities from the purchase of supplies and services regardless of who does the work.

Wood Products

Restoration treatments produce commercially-valuable forest products. Table 26 shows the expected wood product volumes under each alternative. These are the total volumes over the life of the restoration project. An average of about one-tenth of the volume would be harvested and processed each year. The actual amounts and types of products produced each year would vary.

Table 26. Estimated total production of forest products removed from the forest. Alternatives 1, 3, 4, and 5 have about the same amounts of products.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Softwood Sawtimber (CCF)	23,700	900	22,000	23,700	26,400
Poles (CCF)	800	100	700	800	800
Posts (CCF)	1,800	0	1,700	1,800	1,800
Firewood (CCF)	3,300	100	3,100	3,300	3,300
All Other Products (Green tons)	28,700	800	26,400	28,700	28,700

Thirty percent of the pole, post, and firewood volume would be available for personal use, and 70 percent would be available for commercial use. Alternatives 1, 4 and 5 produce the same amount of material. Fewer acres are treated under alternative 3, so wood product volumes are slightly lower.

Economic Efficiency

The economic efficiency analysis measures the ratio of benefits to costs resulting from project activities. In other words, does the value of products and services from the treatments offset the costs of the treatments? We are doing restoration treatments and expect positive benefits. But it is difficult to put a value on these benefits, such as ecosystem services or a reduced risk of wildfire.

The net present value[25] of the action alternatives over the 9-year treatment period is shown in table 27.

Table 27. Net present value of the restoration treatments for each action alternative

	Alternative 1	Alternative 3	Alternative 4	Alternative 5
Net Present Value	$104 million	$103 million	$66 million	$104 million*

*Estimated value

The value of alternative 4 is lower because there is less prescribed fire. These figures can be seen as a substitute for the economic value of the restoration treatments.

Although a simple comparison of treatment costs to wood product value may show that treatments are not cost effective, including the value of ecosystem services changes the equation and can show a positive economic benefit. Thus, the proposed vegetation, prescribed fire, habitat, watershed, and other restoration treatments would yield long-term positive economic benefits. These benefits are discussed below.

Wood Products and Treatment Costs

Using or selling wood products is a way to offset costs. To get economic benefits from wood products it is important to have harvesting and processing facilities nearby (Nielsen-Pincus et al. 2012). When facilities are close to the woods, there are fewer losses due to increased transportation costs and local contractors can be used to do the work (Hjerpe and Kim 2008). There are no harvesting and processing facilities near the project area. This lack of facilities would increase costs to contractors. The value of wood products would also depend on market conditions and the type of contract used.

Doing landscape-scale restoration treatments (approximately 15,000 acres per year), as we are proposing, is supported by research. Economies of scale can be gained with large prescribed fires and thinning treatments. The cost per acre for treatments is lower when more acres are treated (Hesseln 2000; Calkin and Gebert 2006; Thompson et al. 2013). Most of the savings for prescribed fire treatments are in planning costs, which stay the same regardless of acres burned. Larger burns could help reduce treatment costs, especially in the Southwestern U.S., where there are few markets and low mill capacity for small diameter trees (Fight et al. 2004).

Wildfire Costs

Landscape-scale treatments may result in reduced future costs for wildfire suppression because the severity and intensity of potential wildfires is reduced (Reinhardt et al. 2008; Thompson et al. 2013). Consideration of other values may reduce or eliminate these cost savings (Reinhardt et al. 2008). In this area, values include tourism, protecting communities, private land, and Los Alamos National Laboratory, and reducing impacts on human health from smoke. We would suppress some future wildfires to protect these values. Treatments would lower wildfire hazard and severity (see fuels section of this chapter), and it would likely cost less to suppress these fires.

[25] The net present value is the present value of future benefits minus future cost and assumes a 4 percent discount rate. This is the discounted cost to the government of the project relative to the average cost per acre that the government pays for restoration treatments. Net present value is the present value of revenues minus the present value of costs. This figure can be viewed as a proxy for the economic value of the treatments.

Ecosystem Services

Ecosystem resilience and ecosystem services (air and water quality, soil productivity, habitat), have economic value (Loomis et al. 1998, 2002, 2003; Venn and Calkin 2011; Wu and Kim 2013). Placing a value on these services is difficult and complex. But economists have been able to illustrate the increased economic value or price of restored forests over untreated forests, including southwestern ponderosa pine forest ecosystems (Wu and Kim 2013).

Communities and organizations that use water produced on public lands are recognizing the value of this ecosystem service. Denver, Colorado, Flagstaff, Arizona, Santa Fe, New Mexico, and irrigators in the Verde Valley (Arizona) have or would consider paying for restoration treatments on public lands to improve water quality and quantity (Mueller et al. 2013; Denver Water 2013; City of Santa Fe 2013; City of Flagstaff 2012).

Prescribed Fire

As presented in the air quality section of this chapter, total smoke emissions from highest to lowest are: 1) a severe wildfire occurring on the same treatment footprint; 2) alternatives 1, 3, and 5; 3) alternative 4; and 4) alternative 2.

The economic consequences of smoke from prescribed fires on individuals and businesses are difficult to quantify (Viers 2005). They would be higher under alternatives1 and 3 because more smoke is produced. Smoke sensitive individuals may incur costs for medical treatment and/or costs related to leaving the area to avoid smoke. Effects would be short term, lasting 5-7 days

Most of the prescribed fire treatments would take place after Labor Day and would likely have fewer impacts on recreation and tourism-based businesses than burns that occur during the spring season. Burning at the beginning of the tourist and recreation season may have a larger negative impact on businesses that need this early season income after the slow winter season. Other local businesses would benefit, regardless of season of activity. The prescribed fire treatments would contribute employment and labor income to forest workers as well as small businesses that would supply these workers with food, lodging, and supplies.

Recreation

The restoration treatments may lead to more visits by mountain bikers and hikers and could lead to a small increase in tourism-related income for local businesses. A study of recreation use in New Mexico found that people took slightly more trips to areas where a low-intensity prescribed fire had occurred (Starbuck et al. 2006). Thinned forests were more attractive to hikers and mountain bikers because the openness made for a more pleasant experience. People were likely to take fewer trips to areas burned in a catastrophic wildfire.

Private Property

Property values may be improved because the risk of severe wildfires is reduced (Kim and Wells 2005). Private landowners should also benefit by the increase in biological diversity and quality of wildlife habitat, scenic values, water quality, and other ecosystem amenity values. Private residents in the project area would be temporarily inconvenienced for 5-7 days during prescribed fire treatments. The timing of the burns may affect activities at the two private camps in the area. If a prescribed fire escaped, it could damage homes, fences, and other private property. The design features and mitigation measures described in appendix A, have been shown to be highly effective in reducing the risk of an escaped prescribed fire.

Social Consequences- Alternatives 1, 3, 4, and 5

The action alternatives are expected to increase or improve nonmarket and social benefits such as spiritual, recreational, and scenic values.

Successful implementation of prescribed fire treatments could bring about increased trust and confidence in the Forest Service by the local communities and the Southwest Jemez Collaborative Forest Landscape Restoration partners. Improvement in rangeland conditions for permittees would help the small Hispanic communities retain their traditions and maintain ties to the land.

Tribal land uses and other traditional or cultural land uses, including subsistence hunting and firewood gathering would be affected by proposed activities. Some areas may not be accessible while treatments are being conducted; these are short-term effects. The mechanical treatments and prescribed fire treatments would improve growing conditions for medicinal and ceremonial plants used by the tribes. The treatments would also protect those important plants from being burned up in a severe fire. The cultural site protection treatments would also protect sites from damage or loss due to severe wildfire. Other social consequences affecting tribal communities are found in the environmental justice section below.

The mechanical treatments and prescribed fire activities could potentially cause serious injuries to forest workers. However, the risk of serious injuries or fatalities from these types of vegetation treatments and prescribed fire activities is extremely low, especially when mandatory safety procedures are followed.

Alternative 2

The previously approved resource management activities would continue to occur in the area over 8-10 years. Forest conditions would continue to decline and the potential for an uncharacteristically severe wildfire is expected to increase. Wildlife habitat, streams, and forest and riparian ecosystems would continue to decline and the sustainability of environmental and cultural resources would be at risk.

There would be less smoke from prescribed fires and thus lower healthcare and travel costs for smoke-sensitive individuals. A severe wildfire, however, is more likely and would produce more smoke. Smoke-sensitive people and other residents who evacuate for health or safety reasons would incur expenses for transportation, lodging, and other living expenses, as well as health care (Kochi et al. 2010). Depending on the severity and length of the wildfire, these costs could be higher than similar costs to avoid smoke from prescribed fires.

In the event of a severe wildfire, businesses in the Jemez Springs area would likely suffer. Visitation would be reduced during the wildfire because of smoke, forest closures, and perceived danger. Businesses may close during evacuations, and lose all revenue during that time. After the fire, visitation would be reduced due to damage or loss of forest resources, wildlife habitat, recreational facilities, and scenic quality. Gross receipts taxes and property tax receipts could be lower, depending on the extent of damage and amount of time the area is closed.

Economic benefits to the local economy from a severe wildfire would be temporary, lasting only a few weeks or months as a result of the increase in jobs and income from the fire suppression and post-fire rehabilitation efforts. If salvage logging took place after the fire, it would create additional logging and manufacturing jobs and additional income for individuals and local businesses that support those workers.

Rangeland Resources

Over most of the area, a dense canopy cover would remain and understory vegetation would continue to decline. There would be less forage for cattle and possible reductions in the number of permitted livestock. This would reduce the income of permittees. The approved prescribed fire treatments, however, may result in a small benefit for some permittees because of improved forage conditions once the area has recovered.

Permitted grazing could be greatly impacted by a severe wildfire. Livestock would be removed from the allotments and grazing would be suspended during suppression and rehabilitation activities. Severely burned portions of allotments would be changed to non-use until vegetation recovered. Permittees could have increased costs for leasing alternative pastures, transporting cattle, and purchasing feed. (Lemhi County 2006). Other impacts include the death of livestock, loss of or damage to fences and other range improvements, and costs of caring for injured animals. Permittees could also lose income while caring for sick and injured animals (Riggs et al. 2001; Lemhi County 2006). After a few years, most of the wildfire area should experience a substantial increase in the abundance of herbaceous forage vegetation (depending on the severity of the fire), which would be beneficial for livestock grazing.

Recreation

No changes to visitor spending or recreational use are expected; the level of resource activity would be about the same as in other years. Some areas may not be accessible while treatments are implemented, but most visitors would likely stay in the general area. The duration of effects resulting from an uncharacteristically severe wildfire would be variable, depending on the extent of damage and loss to recreation sites and facilities. There would likely be a temporary loss of recreational visitation, tourism, and business services due to forest closures. Fire-related damage to and loss of recreational facilities, trails, and community buildings, equipment, and infrastructure may also occur.

Other Economic and Social Consequences

A large, uncharacteristically severe wildfire is more likely under this alternative. Post-fire mudslides and flooding commonly cause even more substantial damage than the fire itself-damaging homes, businesses, forest resources, and community water supplies- as happened after the Las Conchas wildfire. After Las Conchas, the cities of Santa Fe and Albuquerque, which get part of their municipal water from the Rio Grande, were forced to switch to alternate water sources because of high amounts of ash in the river water. The ash affected water quality and could have damaged water plant equipment (Fleck 2011). Damage to water supplies for Ponderosa, Jemez Pueblo, San Ysidro, and Jemez Springs could be quite severe.

Costs of repairing, restoring or replacing the natural resources and properties damaged or lost would be most significant. Federal agency costs for suppression of the 2000 Cerro Grande fire were $33.5 million, with a total cost of nearly $1 billion, including emergency land rehabilitation, loss of property, infrastructure, and natural resources. Suppression costs for the Las Conchas wildfire exceeded $41 million; the 2005 Dome Fire cost $7.5 million. Suppression costs for all wildfires on the Santa Fe National Forest over a 20-year period averaged $911 per acre, or over $9 million for a 10,000-acre crown fire (SNF 2005).

Indirect economic costs to the agencies and the public include costs resulting from the loss of tax revenue, property values, mental and physical health, water supplies, and other ecosystem services (Viers 2005; WFLC 2010). Individuals may incur unexpected expenses such as food and lodging if they are evacuated, medical expenses for injuries or illness, pet and livestock boarding costs, and lost income (Viers 2005).

Even if no severe wildfire occurred, the elevated hazard of a wildfire would have negative consequences. Fire restrictions and forest closures would likely reduce tourism spending in local communities. The forest may incur overtime costs for employees to patrol when restrictions or closures are in place and would lose campground fee revenue during forest closures. A severe wildfire or temporary forest closures due to fire risk would result in a temporary loss of plant gathering areas and affect other traditional cultural land uses by local tribes.

There would be little or no effect on community services (police, fire, medical), or existing land uses. In the event of a severe fire, effects include reduced availability of local emergency resources (police, fire, medical) during the fire episode; short-term increases in traffic and noise in local communities from fire suppression vehicles and aircraft. Some residents and businesses could be asked to evacuate the area during such a wildfire; and often there are some people who are unable or unwilling to evacuate the danger zone in a timely manner (Drabek 1994; Halvorson 2002).

Environmental Justice

This section addresses environmental justice issues for all alternatives.

There is a high potential for adverse impacts to low-income and/or minority communities due to smoke from prescribed fires under all alternatives. These impacts would be short term, lasting 5-7 days. The areas most at risk are: Sandoval County, Jemez Springs, Jemez Pueblo, San Ysidro, Cañon, and Ponderosa. Smoke would travel down the Jemez River Canyon and into the above communities and would be heaviest in the evening. Smoke from prescribed fires could affect the health of elderly residents and those with respiratory problems in these at-risk communities, as well as residents and visitors living or staying near the project area. Similarly, smoke from an uncharacteristically severe wildfire would likely affect all residents and visitors living near the wildfire area.

The use of smoke reduction techniques and mitigation measures described in appendix A would reduce the amount of smoke produced by prescribed fires. These techniques would also reduce the potential for large accumulations of smoke to settle in Jemez Pueblo or other local communities for any length of time. Mitigation measures also include notification of potentially affected communities before and during prescribed fire treatments. Please see the air quality and fuels sections of this chapter for more discussion on prescribed fire management and smoke.
Economic Consequences

The mechanical treatments would create jobs under all action alternatives (1, 3, and 4). Some of these jobs may be filled by residents in the pueblos and at-risk communities (see also Environmental Justice section below). Businesses in these communities may benefit by providing services and equipment. There would be fewer employment opportunities under alternative 2.

Forest Products

Under alternatives 1, 3, 4, and 5, vegetation management projects would provide wood products for personal use, including firewood. There would be fewer wood products under alternative 2.

Wood fuel is used by many residents to heat their houses. In Jemez Pueblo, 41percent of the housing units heat with wood; in Jemez Springs, 31percent. This is a beneficial effect.

Social Consequences

Forest restoration treatments implemented under alternatives 1, 3, 4, and 5 would enhance and protect traditional cultural properties and uses and cultural sites important to Native American communities. Fewer cultural sites would be treated under alternative 2. Cultural sites and properties would be at risk from an uncharacteristically severe wildfire, and forest resources would continue to decline.

Forest Plan Amendments

The amendments related to developing viewshed corridor plans and clarifying interspaces for the goshawk guidelines would have no effects on social and economic considerations or environmental justice. These amendments would not affect the amount and type of wood products produced, number of jobs, implementation costs, or labor income.

The amendments related to vegetation treatments in Mexican spotted owl habitat would have beneficial impacts on social and economic considerations and environmental justice. With these amendments in place, the risk of an uncharacteristically severe wildfire would be reduced. The amount and type of wood products, number of jobs, implementation costs, and income as previously described for alternatives 1, 3, 4, and 5 would not change. The amount of smoke produced by prescribed fires would be slightly greater than under alternative 5, but this is an insignificant amount (see air quality specialist report). Smoke impacts from all action alternatives would be similar.

Traditional uses, traditional cultural properties, and archaeological sites would be enhanced and protected as described in the environmental justice section below. More archaeological sites would be treated than under alternative 5. Communities in the Jemez River Valley would benefit from jobs and labor income related to the restoration treatments.

The other amendments regarding changing the scenery objective in the Jemez NRA and conducting surveys in peregrine falcon nesting habitat would have beneficial impacts on social, economic, and environmental justice concerns under all action alternatives (1, 3, 4, and 5). More of the area would receive restoration treatments. The use and sustainability of traditional uses, traditional cultural properties, and cultural sites would also be enhanced. The social, economic, and environmental justice consequences are similar to those previously described for alternatives 1, 3, 4, and 5.

Cumulative Effects

The area of consideration for cumulative effects of the action alternatives is Sandoval County, including the communities of Jemez Springs, Jemez Pueblo, and Ponderosa. Most of the social and economic effects discussed would be expected to occur within this county.

Restoration activities would occur on adjacent public lands. Restoration treatments would also increase ecosystem resilience in the Southwest Jemez Mountains. Mechanical treatments and other restoration activities on Valles Caldera National Preserve and potential pumice mine development on the forest would further increase economic benefits and opportunities and social benefits.

Overall, the increase in jobs and income from the proposed action would not have a significant effect on the regional economy. Individuals and households, however, would benefit from the increase in jobs and income. Manufacturing would continue to be the dominant industry in this economy. The other economic sectors would likely remain relatively unchanged regardless of the minor additive effects of restoration activities in the area.

Recent past, ongoing, and planned fuel reduction projects would continue to occur on adjacent tribal lands and other Federal, State, and private lands surrounding the project area. These would have a short-term cumulative impact on forestry-related employment and jobs. Fire hazard would be further reduced throughout the area.

The Landscape Strategy (USFS and VCNP 2010) projected that the Preserve would use prescribed fire on nearly 58,000 acres over 10 years. Bandelier National Monument, The Los Alamos National Laboratories, Los Alamos County, and Jemez Pueblo may also implement prescribed fires Because of the small windows of opportunity for burning that exist in the Southwest Jemez, it is possible that the these agencies would have concurrent or consecutive prescribed fires. The effects of these burns on air quality would be reduced to the extent possible through coordination with the New Mexico Environment Department.

Conclusions of Effects

This section answers the analysis questions and how well the alternatives address the purpose and need and the relevant issues.

Would the smoke from prescribed fires affect minority and/or low income communities disproportionately?

- Yes, minority and/or low income communities would be affected by smoke from prescribed fires. This is a short-term impact lasting 5-7 days. The areas most at risk are: Sandoval County, Jemez Springs, Jemez Pueblo, San Ysidro, Cañon, and Ponderosa. Prescribed fire management techniques and other measures (appendix A) would reduce impacts from smoke. Communities would be notified before prescribed fire treatments are implemented. Prescribed fire and other treatments would also benefit these communities and help sustain traditional uses and resources.

What are the costs associated with avoiding or treating the adverse health effects of smoke from prescribed fires?

- Smoke-sensitive individuals may have costs for travel, lodging, medication, and healthcare. People may lose income because they are ill and cannot work or because they leave the area. These costs are variable and affected by a person’s sensitivity to smoke, financial state, job, or desire to stay or go. Conditions at and during burning will affect the amount of smoke produced and thus its impacts.

To what extent would the sale of wood products offset treatment costs of the restoration treatments?

- We expect that the sale of wood products would offset treatments costs, but we don’t know by how much. It’s not likely to be a positive net benefit because most of these types of treatments will cost more than the value of the wood removed. This is especially true here in the Southwest where product value is quite low. Other benefits of these treatments provide enormous value, but are difficult to quantify. These benefits include ecosystem services and reduced wildfire suppression costs. Pricing these types of benefits and including them in the cost-benefit analysis changes the equation and often shows a positive economic benefit.

What type and amount of economic opportunity, including employment, would be created?

- All alternatives would create employment and labor income (see tables 1 and 2). These would be highest under alternatives 1, 3, 4, and 5. Timber activities and restoration treatments provide the most opportunities.

What type and amount of wood products would be generated?

- The mechanical treatments would produce sawtimber, posts, poles, firewood, and other biomass. Thirty percent of the pole, post, and firewood volume would be available for personal use, and 70 percent would be available for commercial use.

Soil and Water Resources

The soil and water resources specialist report (Snyder 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions, and limitations. The Landscape Assessment (USFS 2010) also has detailed information about soil and water resources in the Southwest Jemez Mountains and is incorporated by reference.

Affected Environment

The resource areas that would be affected by the proposed treatments are streams (ephemeral, intermittent, perennial), water quality, upland function, soil resources, and riparian area conditions.

Hydrology and Water Quality

The climate in this area varies because of the mountain and canyon topography and the wide range of elevation. Average precipitation, rain and snow combined, is 18.3 inches per year. Most of the precipitation falls during the summer rainy season, July through October in the form of high-intensity, short duration thunderstorms. A second wet season extends from December to March.

The project area lies within 12, 6th hydrologic unit code (HUC) subwatersheds: Cañon de la Cañada, Church Canyon-Jemez River, East Fork Jemez River, Headwaters Borrego Canyon, Outlet Borrego Canyon, Outlet Rio Cebolla, Outlet San Antonio Creek, Rio Guadalupe, Sulphur Creek, Vallecito Creek, Vallecito Creek-Jemez River, and Virgin Canyon. Outlet San Antonio Creek is a priority watershed[26] for the Santa Fe National Forest. All water from this area drains to the south towards the Jemez and Rio Grande Rivers and into the water system for the entire Albuquerque-Rio Rancho area. All of these subwatersheds were rated as good (functioning properly) or fair (functioning- at risk) under the forest's watershed condition assessment.

[26] The forest is concentrating restoration activities in priority watersheds to maintain or improve watershed condition. The Outlet San Antonio was selected as a priority watershed in part because of its importance to downstream domestic water supplies.

There are 113 miles of perennial (year-round) streams and 394-miles of intermittent (flows in response to precipitation) streams (figure 43). Most streams are partly perennial and partly intermittent. There are no New Mexico Outstanding Natural Resource Waters streams or wetlands in the project area. The following streams or sections of streams in the area do not meet water quality standards under the Clean Water Act and are called impaired waters: Redondo Creek, San Antonio Creek, Jemez River, Rio Guadalupe, East Fork Jemez River, Sulphur Creek, Vallecito Creek, and Rio Cebolla. Problems include high water temperatures, high turbidity (cloudy water), high pH, and high levels of aluminum and dissolved oxygen (NMED 2012). The high temperature and high levels of aluminum are probably due to the rock type that underlies the area (USFS 2010).

Stream channels in the project area are primarily affected by roads and trails (authorized and unauthorized), as well as past grazing and timber harvests. There are 14 miles of system trails and many unauthorized off-road vehicle trails, livestock trails, and old logging trails in the project area. Unsurfaced (dirt) roads cut through some streams or are directly adjacent to streams and add sediment to streams.

High densities of trees have altered the hydrologic regime (water cycle) of the streams in these watersheds. Rain and snow are caught in the tree canopy, and so less water is absorbed into the soil (Baker 1999; Dore et al. 2010). Eventually, less water reaches the aquifer and stream flows are lower, especially later in the year. Piñon-juniper stands are also too dense, and understory plants, which keep the soil in place, are absent or sparse.

The water supplies of several communities are downstream of the project area: the Village of Ponderosa, which gets its water from springs near the Paliza Campground; Village of Jemez Springs, Jemez Pueblo, and San Ysidro. The spring source and infiltration gallery of the Ponderosa water supply are located near the Paliza Campground.

Wetlands, Riparian Areas, Seeps, and Springs

There are 8 wetlands totaling 8 acres and nearly 4,600 acres of riparian areas. There are about 4,500 acres of floodplains in the area, which almost exactly overlay the riparian areas. Forty-three (43) springs and seeps are also located here. We have very little information about historic flow or water quality from these springs. Many of the springs have been adversely affected by human activities including recreation, grazing by domestic livestock and ungulates (elk, deer), and piping water offsite to spring boxes and water troughs. Many springs are now in a declining or degraded condition. Most of these features are in a degraded condition or function right now, and will continue to decline.

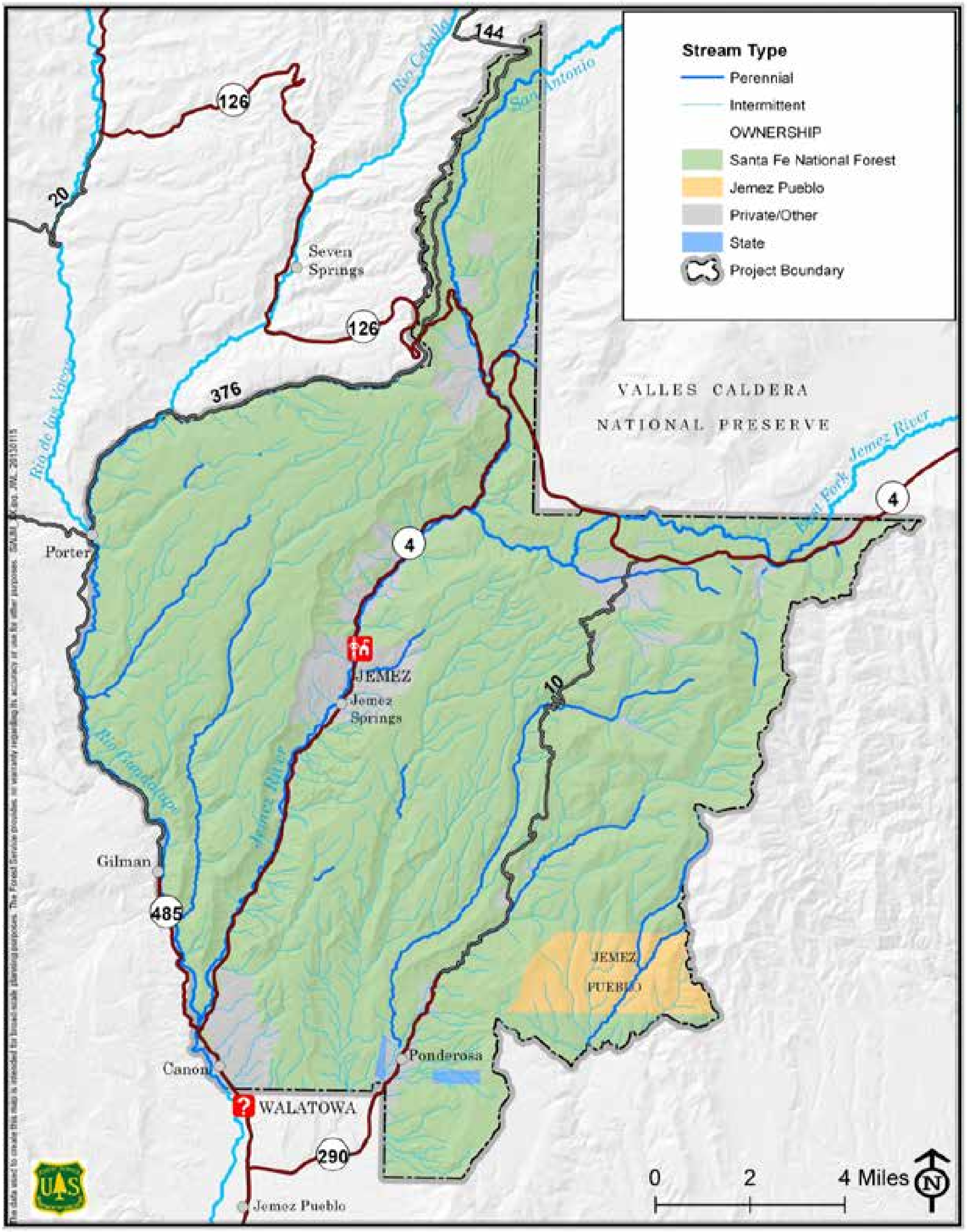

Figure 43. Perennial and intermittent streams in the project area.

Topography and Soil Quality

The project area consists of rugged, forest covered terrain at elevations from 7,000 to 9,000 feet. Soils in the area are formed about equally from volcanic ash flows and lavas, or from sandstones, siltstones, shales, and carbonates. Deeper, moister soils are found at higher elevations and have more organic matter. They are productive growing environments for trees. Soils on the mesa tops are more arid and have deep clay layers. The intense monsoon rains contribute to sheetwash erosion (a film or sheet of water that covers the ground) and soil creep (slow movement of soil and rock). The volcanic soils are highly erosive.

Soil loss rate (erosion) is an indicator of soil condition, productivity, and sustainability[27]. Soils in the assessment area are generally in satisfactory condition in terms of soil loss rate, particularly in the ponderosa pine, mixed conifer, aspen and riparian vegetation types. The satisfactory condition means that long-term soil productivity is being maintained and the soil will nourish and support tree and plant growth. The piñon-juniper woodlands have a greater percentage of soils that can easily erode. High soil loss rates often mean that too much soil is getting into the streams; this degrades water quality.

There are small, localized areas with higher soil loss rates in areas where people camp, drive, or park, and where livestock use is concentrated. In other areas, the soil is naturally unstable and erodible. Most of the soils in the piñon-juniper woodlands erode easily, especially when the tree cover is at or over 40 percent. This is because there are fewer grasses and other herbaceous understory plants to hold the soil in place. In these areas soil erosion and loss are high and the long-term productivity of the soil is at risk.

Livestock grazing reduces herbaceous ground cover, which can contribute to accelerated soil loss, soil compaction, and declined soil productivity, especially during periods of drought. The current livestock grazing and other ungulate grazing in some areas is not improving or maintaining proper watershed function.

Roads and off-road vehicle use contribute the most to loss of soil productivity and impacts on water quality. There are approximately 1,330 miles of roads throughout the total area of the subwatersheds (HUC 12s). Road density exceeds the forest plan standard in many areas. Most of the roads in the area are primitive dirt roads with little or no drainage control. Many roads run along canyon bottoms, and criss-cross stream channels. The travel management analysis (USFS 2012a) found that most of these roads pose a risk to water quality, soil, wildlife, and other resources.

Erosion hazard is another way to rate soil condition. Erosion hazard measures the likelihood that soil loss will exceed tolerable levels if there is a complete removal of vegetation and topsoil, as might happen after a severe wildfire or flood. About 35 percent of the soils in the assessment area have an erosion hazard rating of severe (figure 44). Sulphur Creek and Outlet San Antonio Creek subwatersheds have the greatest percentages of highly erosive soils, each at about 75 percent.

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[27] Soils are rated as Satisfactory, Unsatisfactory or Unsuited by comparing current soil loss rate to a tolerance condition. Soil loss is rated as satisfactory where the soil loss rate is less than the soil tolerance threshold defined for each soil type (TEUI unit).

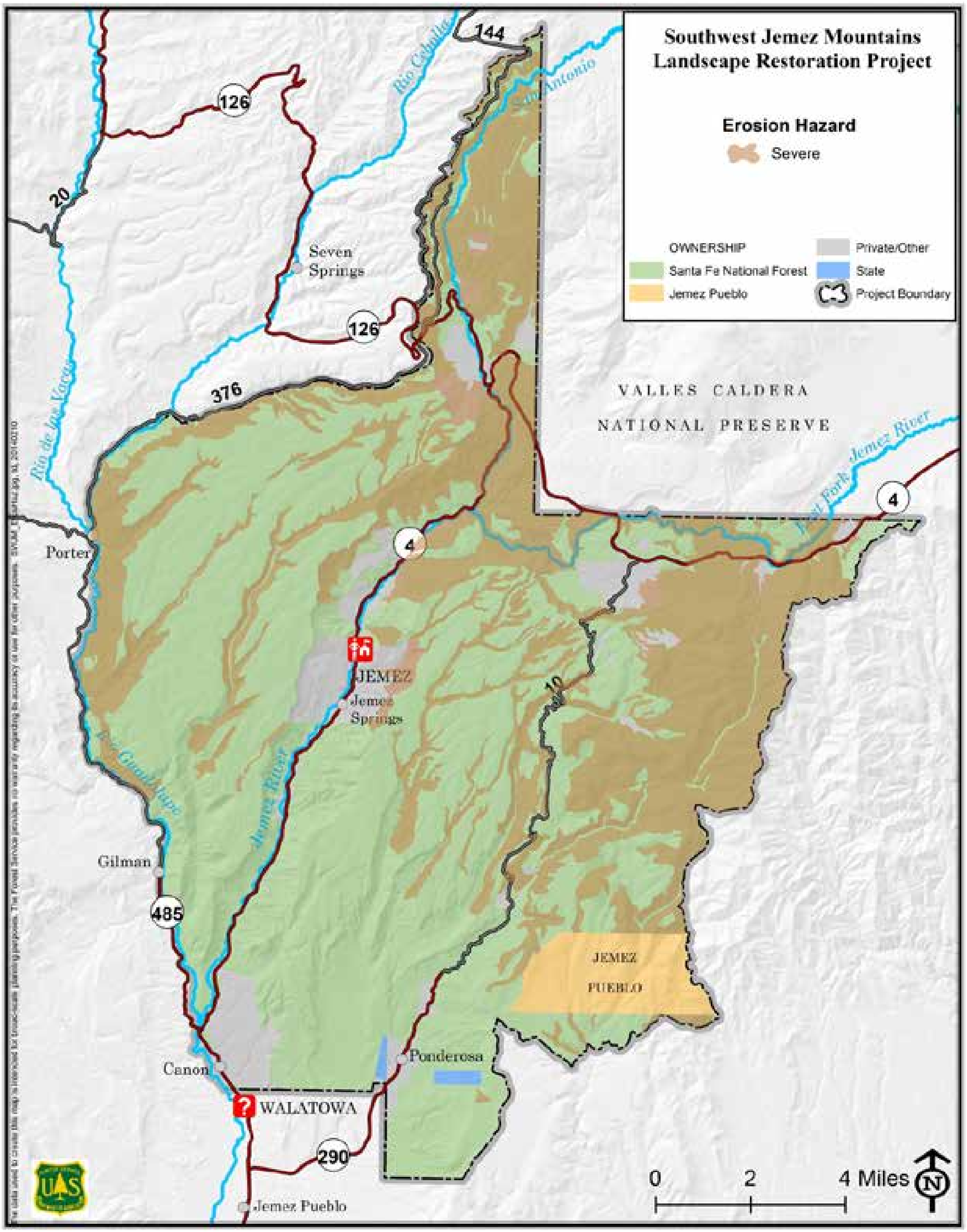

Figure 44. Areas with an erosion hazard rating of severe.

Methods Used to Analyze Effects

The environmental consequences will be described qualitatively and quantitatively at the 6th code level and are supported by past studies and observations. The primary tool used for this analysis is the Equivalent Disturbed Area (EDA), also known as the Equivalent Roaded Area (ERA) (Seidelman 1981; USFS 1988). The EDA/ERA analysis calculations will determine potential risk to watershed functions and water and soil resources. The EDA/ERA measures the acres of soil in a watershed that would be disturbed by the proposed actions. It assumes that these disturbed acres are bare soil.

Information and data sources used are (1) Terrestrial Ecosystem Survey (TES) for the Santa Fe National Forest (Miller et al. 1993); (2) Watershed Restoration Action Plan-Outlet San Antonio (SNF 2011); (3) the Santa Fe National Forest Plan, (USFS 1987); (4) the Landscape Assessment (USFS 2010) and (5) agency reports and scientific literature. Resource specialists from the forest and the New Mexico Environment Department) and other collaborators and cooperators also contributed. Soil and watershed conditions were assessed using Geographic Information Systems (GIS) data obtained from the Santa Fe National Forest GIS corporate database.

Effects on 6th-code watersheds were assessed quantitatively by comparing predicted effects from major ground-disturbing activities including mechanical treatments, prescribed fire, wildfires, and livestock grazing. The threshold of concern was set at 15 percent; this is less than the 20 percent threshold in the forest plan. This means that 15 percent of the acres in the project area can be disturbed before additional protective measures are needed. Some of the treatments would take place in 6th-code watersheds that currently exceed the 15 percent threshold of concern. The additional protective measures in appendix A would be used when treatments are started.

Analysis Questions

The analysis questions were derived from the purpose and need and the issues that arose during scoping as described in chapter 1. The relevant analysis questions are:

- Would project activities improve the function of riparian ecosystems and streams?
- Would there be less erosion, bare soil, and unstable or bare streambanks?
- Would there be less erosion and fewer headcuts and gullies in upland areas?
- Would there be fewer impacts from roads?
- What are the effects of the mechanical treatments and landscape burning on water quality?

Other concerns related to soil and water resources came up during scoping: impacts of prescribed fire ignition devices on water quality, effects of cutting trees on water quantity, and effects of prescribed fire treatments on soils and watersheds. These concerns were addressed in the scoping report, which is in the project record.

Summary of Effects

Effects common to all alternatives:

- The amount of sediment getting into streams would be reduced by these treatments: road decommissioning, streambank stabilization, instream habitat and channel work, campsite rehabilitation, and improvement of roads and road-stream crossings.

- The heavy machinery used for the instream work, would produce short-term increases in sediment and turbidity in the sections of streams downstream from the work site. Heavy machinery used in the mechanical treatments would have short-term effects (0-3 years). Treatments would leave areas of bare soil that is prone to erosion.
- Protecting seeps and springs from grazing animals would allow native vegetation to return. The vegetation would stabilize and shade the area and maintain spring and seep function.
- Water yields and water storage capacity of the soil would increase because of prescribed fire and mechanical treatments.
- None of the action alternatives would contribute enough sediment or other pollutants to intermittent drainages to result in impairment of any downstream waterbodies.
- The difference among the alternatives in the EDA/ERA indicator used to measure effects is minor. This difference is minor, but the risks associated with alternatives 3 and 4 are much larger. The untreated acres are at risk of a severe wildfire that would damage soils and watersheds more severely than if mechanical treatments or prescribed fires were used.

The EDA/ERA indicator shows that there is only a slight difference in soil disturbance among the action alternatives (tables 28 and 29). An additional 531 acres of soil would be disturbed under alternatives 1 and 4 than under alternative 3 because more acres are being treated. The additional 1,830-acres treated under alternatives 1 and 4 would move more quickly toward a functional fire-adapted ecosystem.

Table 28. Equivalent disturbed area/equivalent roaded area (EDA/ERA) values for mechanical treatments across the landscape. There is only a 0.2% difference in disturbed acreage between alternative 3 and alternatives 1 and 4.

	Alternative 1	Alternative 3	Alternative 4	Alternative 5
EDA/ERA*	4.8%	4.6%	4.8%	5.0%
Acres Treated**	46,745 acres	44,915 acres	46,745 acres	48,065 acres
Potential EDA/ERA Disturbed	13,556 acres	13,025 acres	13,556 acres	13,949 acres

Table 29. Equivalent disturbed area/equivalent roaded area (EDA/ERA) values for prescribed fire use across the landscape. There is only a 0.9 percent difference in disturbed acreage between alternative 4 and alternatives 1, 3, and 5. This is because fewer acres are disturbed by prescribed fires under alternative 4.

	Alternative 1	Alternative 3	Alternative 4	Alternative 5
EDA/ERA*	2.2%	2.2%	1.3%	2.2%
Acres Treated	76,888 acres	76,888 acres	45,300 acres	76,382 acres
Potential EDA/ERA Disturbed	1, 692 acres	1,692 acres	589 acres	1, 611 acres

Environmental Consequences

Alternative 1

Mechanical Treatments

Mechanical treatments (including aspen regeneration and meadow enhancement) have the potential to adversely affect watershed response[28] and water quality. Heavy machinery would disturb the soil, which could lead to soil detachment and transport. This would have a short-term, adverse effect on water quality. Use of the design criteria, mitigation measures, and BMPs (see appendix A) would limit the amount of soil lost. There would be some short-term effect on soil detachment and transport (erosion), but the location and magnitude would not adversely affect long-term water quality.

Mechanical treatments would reduce basal areas and canopy cover. With fewer trees, more precipitation would reach the ground and be absorbed into the soil. Understory vegetation would also increase after trees are cut (Baker 1999, Brown et al. 1974, Rich et al. 1976). This in turn would slow the overland flow of water and improve water absorption into the soil. With more surface vegetation, the organic layer of the soil would increase over time. This thicker organic layer would allow the soil to hold more water (Shepperd et al. 2006). Treatments in piñon-juniper and aspen would have similar effects, but these effects would be greater in aspen (Calkin et al. 2011). Regenerating aspen stands may also result in increased soil carbon storage (Woldeselassiea et al. 2012) and increased water yields (Harper et al. 1981). Finally, removing encroaching conifers from meadows may increase water yield for 6-10 years (Baker 1982). This effect diminishes as conifers grow back.

Prescribed fire

Prescribed fire would likely help increase available soil moisture by reducing evapotranspiration by overstory trees (Springer et al. 2008). With fewer trees, more rain and snow would reach the ground and be absorbed into the soil. It would not get caught in the tree canopy and evaporate.

Prescribed fire would remove the existing layer of pine needles, small branches, and other litter and duff. This would increase understory vegetation and lead to improvements in water absorption, like the mechanical treatments do (Kaufmann 1985; Ffolliott et al. 1989; Baker 1999; Bartos 2001; Baker 2003; Dore et al. 2010). Prescribed fire would also create a source of large woody debris and improve soil nutrient cycling. Burning would release nutrients in the pine needles and other fine fuels, which would move into the soil.

Riparian areas next to ponderosa pine forest are adapted to minor pulses of sediment and ash in stormwater runoff after low-severity fires. The sediment and ash provide nutrients that support riparian vegetation. Riparian areas are expected to respond positively to low-severity prescribed fire as a result of increases in available water and nutrients.

Prescribed fire that burns with a high intensity (hotter) could damage the soil, especially in areas where there is more fuel, like riparian areas. A lighting pattern that allows fire to back down into riparian areas would prevent soil damage. Protective measures are found in appendix A.

[28] The watershed response is the interaction between the vegetation and precipitation, and whether rain and snow are absorbed into the soil or not.

Other Treatments

The road treatments, instream work, headcut treatments, campsite rehabilitation, and streambank stabilization would improve water quality by reducing the amount of sediment that goes into streams. Estimated reductions in sediment for some of these treatments are:

- Road decommissioning- 29,430 tons of soil
- Campsite rehabilitation- 19 tons of soil
- Instream work and streambank stabilization- 623 tons of soil

These reductions would occur over the life of the project.

Alternative 2

Over the short term, there would be less soil disturbance because there would be fewer types of ground-disturbing treatments and fewer acres would be treated. Watershed conditions, however, would continue to decline because most of the area would be covered by dense stands of trees. Most of the snow and some of the rain would be intercepted by the canopy and evaporate or transpire. Less water would be absorbed into the soil and there would be less surface water and groundwater quantities in the watersheds. This would result in a long-term decrease in watershed function and resiliency.

Short-term water quality would remain about the same as it is now. Stream channel and floodplain conditions would continue to decline. It is likely that the Rio Cebolla would be redesignated[29] as an impaired stream because of sediment and turbidity.

If an uncharacteristically severe wildfire occurred, the trees, ground vegetation, woody material, and organic matter on the forest floor would be lost over much of the area. The surface would be bare soil covered by ash. The high heat intensity of a wildfire would cause some soils to be hydrophobic, meaning water would run off rather than infiltrate the soil. Studies comparing fuel reduction thinning projects and wildfires in the Southwest show that wildfires typically produce about 70 times as much sediment as thinning treatments (Neary et al. 2005).

There would be severe soil erosion on steep slopes (over 40 percent) after a severe wildfire. After a severe rainstorm, there would likely be areas of mass erosion, excessive water and sediment runoff, gully formation, and some flooding of the streams just downstream from the project area. These are effects similar to the flooding in Santa Clara and Cochiti Canyons after the Las Conchas wildfire. Water quality and drinking water supplies of downstream communities could be affected for decades (Rhoades et al. 2011).

Using the EDA/ERA indicator, a severe wildfire would cause an unacceptable increase in soil disturbance. Watershed recovery from such a wildfire could take years, decades, or even centuries (Rhoades et al. 2011). Severe fires like Rodeo Chediski, Cerro Grande, Wallow, Las Conchas and others leave watersheds and large areas of soil severely burned. Some watersheds may not be able to recover and the landscape would take many years to recover, if at all (Neary et al. 2010).

[29] Rio Cebolla was delisted for sedimentation in 2008.

Alternative 3

Effects from prescribed fires and other treatments are similar to those discussed under Alternatives 1 because the same amount of acres would be treated. Effects on water quality would be similar to those discussed under alternative 1 if a severe wildfire does not occur on the untreated acres. A severe wildfire burning on the untreated acres could have a long-lasting negative impact on water quality. Some streams could be listed as impaired.

About 1,900 fewer acres would be mechanically treated because temporary roads would not be built. Effects would vary depending on where the untreated acres are located, but a wildfire or prescribed fire would burn more severely in the areas that are not mechanically treated because there is more fuel. If these areas are located near the headwaters of a stream, stream reaches could become dysfunctional, as described under alternative 1. Observation of wildfires throughout Arizona and New Mexico has demonstrated that when a minimum of 300 acres located in the headwaters of a watershed has a moderate to high soil burn severity, the stream channel cannot respond properly (Snyder 2013). The water runoffs would downcut the stream channel to the point where water cannot flow out on the floodplain.

Alternative 4

Effects from mechanical treatments and the other restoration treatments are similar to those discussed under alternative 1 because the same amount of acres would be treated. Effects on water quality would be similar to those discussed under alternative 1 if a severe wildfire does not occur on the untreated acres. A severe wildfire burning in an area that was not treated with prescribed fire could have a long-lasting negative impact on water quality. Some streams could be listed as impaired.

Effects from prescribed fire would be different under this alternative because fewer acres are treated. The areas not treated by prescribed fire would have more fuels. Ecosystem conditions on those untreated acres would decline and watershed function and response would decrease. Soil nutrient cycling would be less effective, and understory plants would be less abundant. With fewer plants, more water would run off instead of being absorbed. A wildfire would be more intense (hotter) because of the higher amount of fuels and soils would be severely burned. This could result in the loss of 3,158,800 tons of soil.

Alternative 5

Under this alternative, there would be no prescribed fire in the core areas of Mexican spotted owl habitat. All other treatments would remain the same. Approximately 700 fewer acres would be treated with prescribed fire than under alternatives 1 and 3.

The EDA/ERA values are approximately equivalent to alternatives 1 and 3 (see table 29). Reducing the amount of acres treated with prescribed fire makes only a very minor difference in the amount of soil disturbance (.005 percent less than alternatives 1 and 3). There is a slight short-term improvement in EDA/ERA in the core areas. Over the long term, however, the lack of treatment in core areas would result in higher fuel loads and fewer understory plants, which would put the core areas at risk of experiencing an uncharacteristically severe wildfire.

There would be minor, short-term improvements in water quality and soil condition under alternative 5 due to the lack of prescribed fire treatments in the core areas. Water quality would likely decline over the long term because of the decline or loss of understory plants that usually slow, intercept, or filter overland water flows (Rhoades 2011). Soil condition would also likely decline over the long term because the dense tree canopy would inhibit understory plant growth and nutrient cycling (Neary et al. 2010; Woldeselassiea et al. 2012).

Forest Plan Amendments

- The amendments related to vegetation treatments in Mexican spotted owl habitat, removing breeding season restrictions, and clarifying interspace treatment in goshawk habitat would have slight effects on soils and water. Without these amendments, fewer acres would be treated with prescribed fire, and fewer acres would be treated to a lower density (basal area). Stand density would remain slightly higher resulting in:
- Fewer grasses and forbs in the understory
- Less soil nutrient recycling
- Reduced interception and absorption of precipitation and overland water flow
- Increased evapotranspiration and greater interception of rain and snow fall in the tree canopy, resulting in less soil moisture and decreasing groundwater recharge.
- Soil condition would also decline sooner because the dense tree canopy would inhibit understory plant growth and nutrient cycling

Cumulative Effects

The area analyzed for cumulative effects on soils and watersheds includes all of the 6th-code (HUC12) hydrologic unit watersheds that intersect the project area. The projects considered in the analysis are found in appendix B.

The cumulative effects combined with alternative 2 (no action) and a severe wildfire would produce an unacceptable risk of watershed disturbance. This disturbance could easily lead to or produce an ecosystem type change or desertification (Rhoades et al. 2011; Neary et al. 2012). If there is no wildfire, ecosystem conditions would continue to decline the potential for an uncharacteristically severe wildfire would increase. This would be an unacceptable watershed function trajectory throughout the project area.

The effects of the action alternatives would not create a significant cumulative effect when added to the effects of recent fires immediately outside the project area and on the Valles Caldera Preserve. The design criteria and best management practices in appendix A would reduce the amount of soil detachment and transport associated with the treatments in all the action alternatives. This will maintain and improve water quality.

Conclusions About the Effects

The action alternatives would meet the purpose and need as stated in the analysis questions:

- Riparian ecosystem and stream functions would improve
- Using prescribed fire in riparian areas would create potential source of large woody debris for streams. Streams would eventually have more large woody debris and there would be more native riparian vegetation
- There would be less erosion, bare soil, and unstable or bare streambanks

- Roads would have fewer impacts on stream sedimentation
- Long-term soil productivity would decline under alternative 2
- Some short-term adverse effects for soil erosion and water quality would occur as a consequence of the restoration actions. An overall long term gain is expected to offset these consequences.

The road treatments, especially road maintenance and improvement of road-stream crossings, would have the most impact on reducing the amount of sediment that gets into streams. Alternatives 3 and 4 disturb less soil than alternatives 1 and 5 because prescribed fire and mechanical treatments are used on fewer acres (see table 3 in chapter 2). This difference between alternatives 3 and 4 and alternatives 1 and 5 is minor, but the risks associated with alternatives 3 and 4 are much larger. The untreated acres or acres with a higher tree density are at risk of a severe wildfire that would damage soils and watersheds more than if prescribed fires or mechanical treatments were used. Alternatives 1 and 5 have similar effects.

Vegetation

The vegetation specialist report (Harrelson and Schantz 2013) is incorporated by reference. See the report for detailed information on data sources, methodology, assumptions and limitations.

The terms mechanical treatment and harvest are used in this section. Mechanical treatment refers to cutting and/or removing trees with chainsaws, feller-bunchers, skidders, masticators, or other equipment. Harvest or harvesting is also known as logging. This is the cutting, removal, and loading of trees or logs onto log trucks (SAF 2008).

Affected Environment

Description of the Forest Cover Types

The Southwest Jemez Mountains landscape is noted for its diversity and includes mainly ponderosa pine, piñon-juniper, and mixed conifer forest cover types. Grasslands, meadows, wetlands and riparian areas are also found across the landscape. The amount of the major cover types (vegetation types) found in the area is shown in table 30 below. The discussion will focus on the cover types that would be mechanically treated and/or harvested: ponderosa pine, dry mixed conifer, piñon-juniper and wet mixed conifer. All of these cover types and features are described in more detail in the Landscape Assessment (USFS and VCNP 2010). The existing condition of the cover types is described in chapter 1.

Table 30. Percent and acres of vegetation types in the analysis area. Ponderosa pine is the most common vegetation type.

Cover Type	Acres	Percent of Area
Ponderosa Pine	43,591	39.9%
Piñon-Juniper	34,497	31.6%
Dry Mixed Conifer	21,950	20.1%
Wet Mixed Conifer	3,910	3.6%
Burned Area (Las Conchas and other recent fires)	3,616	2.4%
Grassland	938	0.9%

Cover Type	Acres	Percent of Area
Aspen	755	0.7%
Oak Woodland	379	0.3%
Gambel Oak (Shrub)	208	0.2%
Rockland, Talus, Scree	241	0.2%
Juniper Woodland	118	0.1%
Strip Mines, Quarries, Gravel Pit	57	0.1%

Ponderosa Pine

Ponderosa pine is the dominant forest type in the area. It ranges from lower elevation, dry sites where it is mixed with piñon-juniper woodlands up to higher elevation, moist sites where it grades into mixed conifer. Overstory tree species found with ponderosa include Douglas-fir, white fir, aspen, juniper and limber white pine. Understory vegetation includes shrubs, Gambel oak, and bunchgrasses. Ponderosa pine regenerates most successfully in openings. Ponderosa pine stands are established and maintained by low-intensity surface fires, logging, or other disturbances that favor shade-intolerant species.

Dry and Wet Mixed Conifer

Mixed conifer forests are complex, highly variable, and have of a variety of species including Douglas-fir, white fir, ponderosa pine, blue spruce, aspen, and limber pine. For consistency with the wildlife habitat analysis, we use the definition of mixed conifer in the Mexican spotted-owl recovery plan (USFWS 1995). This definition includes stands within Douglas-fir, white fir, limber pine, and blue spruce habitat series[30].

Most of the mixed conifer in the project area is dry mixed conifer and is typically found at lower elevations than wet mixed conifer. Ponderosa pine and Douglas-fir are the main species. In some areas, shade-tolerant species such as white fir are becoming dominate in the understory due to past fire suppression and past management practices. Historically, dry mixed conifer stands were uneven-aged due to disturbances. Heavy regeneration events, harvesting, and fewer natural disturbances have created stands that are dominated by one or two age classes. This forest type now has an understory of shade tolerant tree species and is much denser than 100 years ago. Conditions then were much more open than they are today, with a more productive and diverse understory of grasses and non-woody plants.

In wet mixed conifer forests Douglas-fir, limber pine, and white fir are the main species. Blue spruce, Englemann spruce, and aspen are also found in wet-mixed conifer stands. Aspen is the early seral stage of wet mixed conifer. The composition of these stands has not changed drastically from historic conditions, but in general, more stands are in a late seral stage.

[30] The definition of mixed conifer is found in part II. C, page 56, of the recovery plan.

Figure 44. Dry mixed conifer forest. This stand has a few large trees. Many of the small trees need to be thinned.

Figure 45. Wet mixed conifer forest. These forests have not changed drastically.

Aspen

Aspen is found in patches associated with disturbance. When a fire, landslide, insect outbreak, or other disturbance kills conifer trees, aspen quickly sprouts and grows. Over time, conifers establish in the shade of the aspen and eventually grow to overtop and shade out the aspen. Aspen remains as clumps or individual trees until the next disturbance. Aspen will frequently grow in the sunny gap created by a single tree that dies and falls over. Some of the aspen groups in the project area are young, dating to wildfires in the 1970s. However, most of the aspen is mature or overmature, with a heavy component of conifers succeeding in its place.

The amount of aspen in the area had been decreasing due to drought and the absence of large scale disturbance, until the recent large fires. This is the case across much of the West. In fact, the total acreage of aspen in the Southwest is decreasing yearly, as the more shade tolerant mixed conifer species, such as white fir, become established and eventually replace the aspen stands.

Piñon-Juniper

Piñon-juniper woodlands are a prominent vegetation type here and are found in the southern part of the project area. It is a diverse type that ranges from open savannas to dense woodlands. The two types of piñon-juniper found here are shrub woodlands and persistent woodlands (Romme et al. 2009). Shrub woodlands are dominated by trees, but have a high cover of shrubs such as turbinella oak, mountain mahogany, and sumac. Persistent woodlands are found on shallow upland soils that favor piñon and juniper over grasses. Sparse grasses, forbs, and/or shrubs interspersed with bare ground make up the understory.

Although a large portion of the project area is covered with piñon-juniper, few treatments are planned there. Much of the area is steep, or inaccessible, or is already close to desired condition. There may be some places where treatments would be beneficial and would be implemented.

Snags and Old Growth

Snags (dead, standing trees) are a key component of wildlife habitat. They are used for roosting and nesting by birds and mammals, and insects in the bark serve as a food source. The current snag population is dominated by the 12 to 18 inch size class (table 31), which reflects the current dominance of small trees in the project area. The number of snags 10-inches diameter and larger meets the general forest plan standard. The number of snags 18-inches diameter and larger, however, is slightly below the forest plan guideline for goshawk habitat, but it has been increasing over the past decade due to mortality from fires, insects and diseases, and dense stand conditions.

Table 31. Average number of snags per acre by cover type

Cover Type	12+ Inches Diameter	18+ Inches Diameter	24+ Inches* Diameter
Piñon-Juniper	2.0	0.5	0.0
Ponderosa Pine	2.7	0.8	0.2
Dry Mixed Conifer	5.6	1.5	0.5
Wet Mixed Conifer	7.8	1.9	0.7

The diameter classes are non-exclusive, so 12+ includes all snags greater than 12 inches, 18+ includes all snags 18 inches and larger, and 24+ includes all snags 24 inches and larger. The forestwide management direction calls for managing for 2 natural snags per acre on a minimum of 40 percent of the ecosystem area.

The forest plan defines old growth as a condition of the forest having structural attributes based on the number of large trees per acre, basal area, canopy cover percent, dead standing trees, and down logs. Old growth is analyzed at three scales: the ecosystem management area (EMA) scale and one scale above and below the EMA in accordance with forest plan direction and definitions (USFS 1987b). Because the project area is quite large, the interdisciplinary team defined the EMA as the entire project area. The Jemez Mountains were used as the scale above the EMA, and forest stands were used as the scale below.

The vegetation types for allocating old growth in the EMA are ponderosa pine and mixed conifer. Old growth standards require allocating at least 20 percent of each vegetation type as old growth in blocks of 40 acres or more, if possible. In ponderosa pine, 8,716 acres were allocated as old growth; in dry mixed conifer, 5,171 acres. Old growth was not allocated in other forest vegetation types because there are few treatments planned in those areas.

Insects and Disease

The level of insect activity has varied over the years. Western spruce budworm has been the most chronic and widespread pest in the Southwest Jemez Mountains area, affecting over 2,000 acres in some years. Within the project area, Paliza Canyon has seen repeated outbreaks. Ponderosa pine mortality from bark beetles spiked last year, mostly due to effects from the Las Conchas fire. Bark beetle hazard is high over most of the area. High stand density increases susceptibility to bark beetle activity and mortality.

Dwarf mistletoe and root diseases are common pathogens in the area. They are slow-acting and their effects are difficult to measure. Root diseases are a chronic condition and spread slowly, and in this area, don’t require any special treatment at this time. Based on stand exam data, about 57 percent of ponderosa stands have some degree of dwarf mistletoe infection. On a stand-level basis, these are light to moderate infections, with isolated spots of heavy infections.

Habitat for Northern Goshawk and Mexican Spotted Owl

This analysis will focus on forest cover types identified in the forest plan (USDA 1987, as amended in 1996) for Mexican spotted owl and northern goshawk habitat and the revised recovery plan (USFWS 2012) for the Mexican spotted owl, namely ponderosa pine and mixed conifer. There is no pine-oak habitat in the project area. All forested habitat was stratified to meet analysis requirements in the forest plan for Mexican spotted owl and northern goshawk (see the wildlife and vegetation specialist reports). There are 25,960 acres of Mexican spotted owl habitat in the project area (mixed conifer). There are 43,491 acres of northern goshawk habitat, (ponderosa pine).

Mexican spotted owl habitat would be managed using direction in the revised recovery plan (alternatives 1, 3 and 4), or using the current forest plan standards and guidelines (alternative 5). Under both the revised recovery plan and the forest plan, 25 percent of restricted or recovery habitat would be managed to meet the target/threshold or nest/roost values. Under the revised recovery plan, 3,733 acres currently meet these values, and an additional 2,031 acres could be managed toward these values. Under the forest plan guidelines, 1,717 acres currently meet these values; an additional 2,792 acres could be managed toward meeting these values. The remaining seventy-five percent of owl habitat could be managed toward an uneven-age condition

Stands that are not being managed for the owl will be managed to comply with the forest plan standards and guidelines for northern goshawk (USFS 1987 as amended). This is a large portion of the project area, approximately 43,500 acres. The objective is to manage for uneven-aged stand conditions over the long term. Currently, 89 percent of the area classified as goshawk habitat is in an even-aged stand condition.

In the forest plan, uneven-aged stand conditions are described in terms of vegetation structural stages (VSS). The VSS should be balanced within the stand and across the landscape. The desired distribution of vegetation structural stages is: 10 percent each in VSS 1 and VSS 2 and 20 percent each in VSS 3, 4, 5, and 6. This is described as an uneven-aged mix of tree sizes distributed with variable spacing, mostly in groups across the landscape. The forest structure should be more like a mosaic than a homogenous, closed canopy forest, like it is now.

Vegetation Structural Stages (VSS)

The VSS class is based on the majority of trees in the specific diameter distribution. There are six classes:

- VSS 1: grass/forb/shrub
- VSS 2: less than 5-inches diameter- seedling-sapling
- VSS 3: 5-12 inches diameter- young forest
- VSS 4: 12-18 inches diameter- mid-aged forest
- VSS 5: 18-24 inches diameter- mature forest
- VSS 6: greater than 24-inches diameter old trees

Existing VSS distribution in goshawk forest habitats was analyzed at three scales: plot-level (fine-scale), stand-level (mid-scale), and landscape-level (ecosystem management area- the project area). The plot-level is the most relevant because treatments are applied at the fine scale, and the objective is to develop within-stand variability over time. Tables showing the distribution of VSS classes at each scale are found in the vegetation specialist report.

Most of the goshawk foraging habitat is in an even-aged stand condition. Stands are dominated by young trees 5 to 12 inches diameter (VSS 3). This shows that the forest is fairly homogenous and lacks regeneration openings (VSS 1), seedlings and saplings (VSS 2), and large trees (VSS 5, 6). Goshawk nest stands and post-fledging family areas are also dominated by small trees in VSS 3 and 4. Conditions are similar at the landscape and plot levels. Other classes, particularly VSS 1, 2, 5, and 6 (mature forest and old trees) are well below the desired condition.

Stand Density

Stand density is a quantitative measure of stocking as measured by the number of trees, basal area, or volume per unit area, or relative to some standard condition (SAF 2008). One measure of density is basal area (BA). This is the cross-sectional area of all the stems in a stand. A higher basal area usually means a higher canopy cover or tree density, less ground cover, and more tree competition. A stand with high basal area could have a few large trees, or many small trees. Hence, it is also useful to know the number of trees per acre, to get a picture of the stand. Trees per acre (TPA) is another measure of density and is the number of standing trees on an acre.

Figure 46. This is the type of opening that forests in the area used to have, where grasses and flowers can grow. Treatments in the proposed action would create more such openings.

Within the project area, in all habitat strata for both the Mexican spotted owl and the northern goshawk, basal area is higher than desired. This indicates that the stands could be experiencing tree mortality and are vulnerable to beetle attacks.

Effects of Past Human and Natural Events on Forest Conditions

The ecosystems throughout this area have been radically altered by past management. Since the late 1800s logging, livestock grazing, and fire suppression have changed the structure, density, and species composition of the forests in the area. Much of the area was selectively logged in the early to mid-1900s. Ponderosa pine was the commercially favored species for removal, and most of the large ponderosa were cut. Other species, such as Douglas-fir and white fir, were often left in the stands.

The natural fire regime has been interrupted since the late 1800s. High numbers of sheep and cattle that grazed in the Jemez Mountains reduced the native grasses that carried surface fires. The Forest Service suppressed wildfires, even those that would have benefited the landscape. Without fire to control their numbers, seedlings and saplings thrived. As a result, the forests are currently dominated by dense thickets of pole-size trees (5-16 inches in diameter). Understory grasses and plants, large, thick-barked pine trees, and old growth are lacking. The species composition has shifted, and ponderosa pine forests now resemble mixed conifer forests with more Douglas-fir, white fir, and limber pine.

Insects and diseases are a natural and common occurrence in all forest types in the Jemez Mountains. In the overly dense forests, trees compete for light, moisture and nutrients. Tree growth and vigor are reduced and forest stands are more susceptible to outbreaks of insects or diseases. Bark beetles, defoliators (leaf eaters), and dwarf mistletoes have had widespread impacts, and their activity has increased in the last year. Nearly 90 percent of the ponderosa pine and dry mixed conifer forests are in a density condition that makes them susceptible to mortality from bark beetle activity.

Methods Used to Analyze Effects

Data on the existing condition of vegetation came from the following sources: stand exams for nearly half of the area covered by ponderosa pine and mixed conifer forest types; the Forest Service GIS Corporate Data (SNF 2012a); aerial photos; and field surveys.

The methods used to analyze the effects of the mechanical treatments were:

- Nearest Neighbor. This computer program was used to assign stand exam data (reference stands) to the stands without stand exam data (Crookston et al. 2002).
- Forest Vegetation Simulator (FVS). This is a modeling program used for predicting forest stand dynamics. The Central Rockies variant of the FVS model was used for this project (Keyser and Dixon 2008).

The stand exam information, field surveys, and aerial photo interpretation were used to determine forest cover types, size classes, and density. Mexican spotted owl restricted habitat was computed using the FVS model. All forested habitat was stratified to meet analysis requirements in the forest plan for Mexican spotted owl and northern goshawk.

In relation to forest vegetation, we identified two main measures:

- Restore spatial pattern, processes, resiliency, structure, and species composition by creating generally open, uneven-aged forests in ponderosa pine and dry mixed conifer types.
- ♦ Indicators: Forest stand conditions including stand density, acres treated, and change in proportion of VSS classes
- Offset treatment costs and provide economic opportunity.
- ♦ Indicators: Amount and type of merchantable sawlogs, firewood, biomass, and other forest products generated.

Analysis Question

The analysis question was derived from the purpose and need of the project as related to forest vegetation:

- Would the mechanical treatments restore spatial patterns, processes, resiliency, structure, and species composition in ponderosa pine and dry mixed conifer types?

This would be measured using indicators of forest stand conditions including basal area, trees per acre, acres treated, and change in proportion of VSS classes.

Summary of Effects

The effects are summarized using the indicators above.

Acres treated

- Alternatives 1, 4, and 5- 31,400 acres would receive mechanical treatments

- Alternative 2- 800 acres are mechanically treated
- Alternative 3- 29,500 acres of mechanical treatments

Resilience, Processes, and Patterns

- Alternatives 1 and 5 are most effective at promoting ecosystem resiliency because more acres would receive restoration treatments, including prescribed fire. Alternative 3 is almost as good.
- The beneficial effects of the treatments in Mexican spotted owl habitat would last longer under alternatives 1, 3, and 4 than under alternative 5 because treatments are heavier (more trees are cut). These areas would also grow larger trees slightly faster under alternative than under alternative 5 because of the reduced density.
- Under alternative 2, resiliency would not improve. The forest would remain overstocked and vulnerable to an uncharacteristically severe fire, insect outbreaks, and heavy dwarf mistletoe infections.
- The 1,900 acres that are not mechanically treated would remain overstocked and vulnerable to disturbances.
- Under alternative 4, resilience is improved on all treated acres, but not as much as compared to alternatives 1, 3, 5. Effects in areas that only receive mechanical treatments would differ depending on how the slash is treated. Slash that is left on site could increase fire hazard. Masticating the slash would be better than leaving it, but stands would still be at some increased risk of wildfire, and fire effects are likely to be more severe. This alternative provides the ecological benefits of fire on 45,400 acres; however, this is far less than alternatives 1, 3, and 5.

Forest Stand Conditions (Stand Density and VSS)

- Alternatives 1 and 5 restore forest structure and species composition and move the forest toward uneven-aged stand conditions as outlined in the forest plan. Alternative 3 also meets the restoration objectives, but on slightly fewer acres. Alternative 4 meets desired stand conditions, but it would be harder to maintain these conditions over time without fire. Tables 32-35 show changes in stand density indicators and VSS classes, before and after treatment. Both basal area and trees per acre are lowest after treatment and are still below pre-treatment levels after 20 years. VSS classes would be better balanced than they are now and eventually reach equilibrium.
- Alternative 2 leaves the forest overstocked and vulnerable to an uncharacteristically severe fire and insect outbreaks and heavy dwarf mistletoe infections.

Economic Opportunity

- Alternatives 1, 3, 4, and 5 create economic opportunity, and alternative 2 does not. Alternative 5 provides a slightly higher volume of wood products.

Table 32. Changes in density indicators for alternatives 1, 3, and 4, by Mexican spotted owl habitat strata. Both basal area and trees per acre are lowest after treatment and are still below pre-treatment levels after 20 years.

Habitat Strata*	Treatment Acres	Basal Area before Treatment	Basal Area after Treatment	Basal Area 20 Years after Treatment	TPA before Treatment	TPA after Treatment	TPA 20 Years after Treatment
MSO PAC	410	135	92	108	634	155	139
MSO Nest/Roost	1,680	178	104	126	1,893	301	288

MSO critical habitat overlaps other habitat strata. Treatment acres are a subset of total treatment.

Table 33. Changes in density indicators for alternative 5 by Mexican spotted owl habitat strata. Both basal area and trees per acre are lowest after treatment and are still below pre-treatment levels after 20 years

Habitat Strata*	Treatment Acres	Basal Area before Treatment	Basal Area after Treatment	Basal Area 20 Years after Treatment	TPA before Treatment	TPA after Treatment	TPA 20 Years after Treatment
MSO PAC	410	135	105	121	634	224	205
MSO Target/Threshold	360	192	128	153	1,856	256	245
MSO Protected	30	163	71	88	1,166	77	73

MSO critical habitat overlaps other habitat strata. Treatment acres are a subset of total treatment.

Table 34. Changes in density indicators for alternatives 1, 3, 4, and 5 by goshawk habitat strata. Both basal area and trees per acre lowest after treatment and are still below the pre-treatment level after 20 years

Habitat Strata	Treatment Acres	Basal Area before Treatment	Basal Area after Treatment	Basal Area 20 years after Treatment	TPA before Treatment	TPA after Treatment	TPA 20 years after Treatment
Goshawk Nest	330	163	71	87	561	59	56
Goshawk PFA	1,220	153	66	83	601	62	58
Goshawk Foraging	20,940	143	58	75	612	62	58

Table 35. Changes in VSS Class percentages at the stand level with proposed treatments for alternatives 1, 3, 4, and 5. VSS classes are better balanced after treatments and are approaching equilibrium.

	All Foraging Areas		Even-age Foraging Areas		Uneven-age Foraging Areas		Post-fledging Family Areas	
VSS Class	Existing	After Treatment	Existing	After Treatment	Existing	After Treatment	Existing	After Treatment
1	<1 %	10 %	1%	10	0	10	2	10
2	1%	10%	1%	10	1	10	1	10
3	52%	19%	53%	19	45	15	47	17
4	35 %	44%	35%	50	35	41	33	42
5	9 %	12%	8%	10	14	13	10	10
6	2 %	5%	2%	2	4	10	7	11

Desired conditions are: VSS 1- 10%; VSS 2- 10%; VSS 3- 20%; VSS 4- 20%; VSS 5- 20%; VSS 6- 20 %

Other Effects

Alternatives 1, 3, and 5

- Improves habitat for Mexican spotted owl and northern goshawk. There are small differences between alternatives 1 and 5 resulting from the treatments in Mexican spotted owl habitat.
- Reduces potential for uncharacteristically severe fire throughout the area and creates forest conditions that promote low-intensity surface fires
- Retains the large trees and old-growth forest structure necessary to manage for the desired condition objectives across the landscape
- Provides economic opportunity and wood products
- Manages for the sustainable presence of aspen across the landscape.
- Alternative 3 accomplishes the same as alternatives 1 and 5, but on fewer acres

Alternative 2

- Habitat for Mexican spotted owl, Jemez Mountains salamander, northern goshawk, and other wildlife would continue to decline
- Aspen continues to decline
- The forest structure of old growth stands would remain susceptible to damage and loss from uncharacteristically severe fires
- Treats fewer acres and reduces the overall scale of mechanical and prescribed fire treatments. The currently approved projects would be implemented. These projects focus on hazardous fuels reduction and not forest ecosystem restoration.

Alternative 4

- Improves habitat for Mexican spotted owl and northern goshawk, but on fewer acres than alternatives 1 and 3
- Retains the large trees and old-growth forest structure necessary to manage for the desired condition objectives across the landscape

- Untreated slash could elevate fire hazard. Does not create conditions that promote low-intensity surface fires in mechanically treated areas
- Higher fuel loads resulting from mastication would result in increased fire intensity and higher fire residual time that would heat up the soil and kill the roots of the trees.
- Fewer acres would receive the ecological benefits of fire
- Fewer acres of aspen regeneration

Environmental Consequences

Alternative 1

Mechanical Treatments

The mechanical treatments would restore ecosystem function and structure in ponderosa pine and dry mixed conifer forests by reducing tree density and creating openings, and interspaces between groups of trees. This natural condition is healthy and sustainable over time. These forests would then be more resistant to uncharacteristically severe fires and stressors such as climate change. Treatments in aspen would reinvigorate existing stands and increase the amount of aspen on the west side of the project area.

Effects on Forest Structure and Function

- Reducing tree density and creating openings and spaces between groups of trees would have positive effects on structure and function:
- A more diverse forest structure with trees of all ages and sizes across the landscape that is sustainable over time. There would be intermingled patches of different sizes and ages. As older trees die, younger ones would grow in behind them
- Groups of trees with interlocking crowns and spaces between the groups, which reduce the potential for crown fires
- Trees that grow to a larger size more quickly because there is more room to grow and less competition for water and nutrients
- A heterogeneous landscape, with varying tree densities. North-facing slopes would have denser forests than south-facing slopes. Stands that are not treated would also add to the overall diversity
- Improved old-growth conditions are reached more quickly because of reduced tree density. Trees grow to larger sizes more quickly and reach desired conditions sooner
- Small groups and stands of aspen would be common and well distributed across the landscape.
- Openings provide full sun for ponderosa pine seedlings to regenerate (sprout)
- Oak trees receive more sunlight and are free to grow to larger sizes that produce more acorns, thus benefiting wildlife
- Grasses and forbs increase in amount and diversity, providing more cover and food sources for wildlife

- Increased resistance to large insect outbreaks because of increased tree vigor. Mistletoe would be at natural levels because the space between groups of trees would make it harder to spread. Prescribed fire would help control infestations

Effects on VSS Classes

Mechanical selection cutting treatments would improve northern goshawk habitat by starting the development of uneven-aged forest stands. In stands that are currently uneven-aged, these treatments would also move the proportion of VSS classes closer to the desired condition. All VSS classes would be present on the landscape and would be better balanced than they are now. Over time, more trees would grow into the larger classes. More free-to-grow regeneration would become established and move toward the desired proportion of the younger age classes.

Table 36 compares the VSS distribution before and after treatments in goshawk foraging habitat. Treatments would emphasize maintaining VSS 2, 5, and 6 (saplings, large, and old trees), which are in short supply, and reducing VSS 3 and 4 (young and mid-age trees) that are overabundant. Right after treatments, the forest has moved toward the desired balance of VSS classes. There would still be too much forest in VSS 4, but VSS 3 would be closer to meeting the objective of 20 percent, dropping from 52 percent to 19 percent in goshawk foraging areas. VSS 5 and 6 would also move closer to the desired condition. Over time, more trees would be recruited into the larger classes. Also, seedlings would be expected to sprout in the created openings and eventually create a VSS 2 class. Results are similar in other goshawk habitat strata (see the vegetation specialist report for these tables).

Table 36. Distribution of VSS classes in northern goshawk foraging habitat before and after mechanical treatments. VSS classes are better balanced after treatment.

	VSS 1	VSS 2	VSS 3	VSS 4	VSS 5	VSS 6
Pre-treatment	<1%	<1%	52%	35%	9%	2%
Post-treatment	10%	10%	19%	44%	12%	5%
Desired Condition	10%	10%	20%	20%	20%	20%

Effects on Stand Density

Changes in the indicators of stand density (basal area and trees per acre) were modeled before treatment, one year after treatment and 20 years after treatment[31]. We find that stand density is greatly reduced. For Mexican spotted owl habitat, basal area ranges from 135-178 before treatment and from 92-104 after treatment. After 20 years, the trees have grown and basal area has increased, ranging from 108-126. After 20 years, basal area has increased, but is still lower than before treatment. The increased basal area also indicates that tree size has increased.

It might seem that there is no need to treat some areas because the current basal area is at or below the target level. These numbers are averages, however, and density is variable across the

[31] The treatment modeled was cutting, piling and burning slash, and prescribed fire one year later. The modeled prescribed fire would kill additional trees. In actual practice, we could modify the burn prescriptions to achieve desired tree mortality levels.

landscape. During implementation, there would be flexibility in cutting to the desired level. Stands that already have a low basal area may not be treated, for example, and this would change the average post-treatment basal area.

Trees per acre also changes. In Mexican spotted owl habitat, before treatment, the number of trees per acre ranges from 634 to 1,893; after treatment, the range is 155-301 TPA. After 20 years, the number has dropped slightly. This is due to the prescribed fire treatments, which control the number of seedlings that survive.

The mechanical treatments reduce stand density, and density stays at lower levels over a 20-year period. Detailed tables showing the changes in these and other indicators are found in the vegetation specialist report.

Large Trees

Because of the concern about cutting large trees, we calculated the percentage of trees removed in the larger diameter classes. The 16-24-inch diameter class was used instead of the 18-24-inch class because the 16-inch diameter has been used in many publications and is of interest to stakeholders.

We estimate that less than 10 percent of the trees larger than 16 inches would be removed to create openings and group structure. This percentage is probably too high because it doesn’t account for prescriptions that favor large trees in old growth areas and Mexican spotted owl restricted, protected, and recovery habitat.

Amount and Type of Wood Products Created

The mechanical treatments and associated timber harvest would create jobs in the woods and the mills and offset treatment costs. The mix of wood products is not certain at present; it would depend on the wood products industry and contractors. The product mix could include firewood, mulch, pellets, fencing, vigas, and lumber for personal and commercial use. The economic effects are described in detail in the social-economics section of this chapter and in the corresponding specialist report.

An estimate of how much tree volume would be removed over the life of the project for all alternatives is shown in table 37. Volume estimates are approximate and would vary because of access, removal methods, transportation costs, and merchantability.

Table 37. Approximate volume harvested by alternative over the life of the project. Alternative 5 produces the most amount of material; alternative 2, the least.

Alternative	Acres Harvested	Total MBF* from Trees Greater than 9- inches Diameter	Total CCF** from Trees Greater than 5-inches Diameter	Total CCF from Trees 5-8 inches Diameter
1	31,400	114,000	342,900	115,000
2	800	4,600	12,500	3,300
3	29,500	105,600	317,100	105,900
4	31,400	114,000	342,900	115,000
5	31,400	118,700	357,200	119,800

* MBF: one-thousand board feet. A board foot is the amount of wood in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide.
* CCF: 100 cubic feet. A piece of wood measuring 12 inches by 12 inches by 12 inches is one cubic foot.

Effects on Fire and Fuels

Stands would be more resistant to high intensity (hot) wildfires, because there is more space between groups of trees and there are fewer ladder fuels. Under these conditions, it is harder for a fire to move from the ground to the tree canopy. Prescribed fire treatments would also help reduce potential wildfire intensity by burning down wood. Fires (wild or prescribed) would generally burn on the ground and be cool (low intensity) because there would be less fuel after the mechanical treatments. Fires may thin within groups of trees by killing a few trees and creating small openings. Most large trees would be able to survive these fires. Most of the trees killed by fire would be seedlings and saplings, which would help maintain lower tree densities over time. (see the fuels section of this chapter and the associated specialist report for more details on treatment effects)

Alternative 2

No stand improvement thinning or restoration cutting would occur, except in a few areas with previously approved NEPA. The trees outside these small treatment areas would continue to grow and stand conditions would continue to decline. Many stands are at maximum carrying capacity, so trees in those areas would continue to die as the stands self-thin. This would create fuel ladders and an elevated fire hazard. Stands that are below capacity would grow until capacity is reached. Because of competition for light, water, and nutrients, trees would be small and stunted and would not be able to reach their potential. Spacing would be dense and fairly uniform. Trees in VSS 5 and 6 would grow slowly. There would continue to be too many trees in VSS 3 and 4 classes, a shortage of VSS 2 seedlings-saplings, and a shortage of VSS 1 openings.

The landscape would become more homogenous over time as stands get older. There would be fewer young and middle-aged stands. The diversity of ages and sizes of trees would decrease over time. It would take a long time for trees to grow to a large size, and many never would.

The existing old-growth stands would remain fairly stable, and trees would grow slowly. The total acres of old growth would increase very slowly because tree growth is suppressed and it would take longer to get large trees. Old-growth stands would be vulnerable to high-intensity fires because of the high density and high fuel loading. We would not be able to manage stands to develop more old growth.

Oaks would be suppressed, short, and shrubby. They would not be able to attain their tree form and produce abundant acorns. Because of the closed canopy, there would be little regeneration of new oaks, and there would be fewer shrubs and much less grass and forbs. The forest floor would eventually consist of pine needles, and dead wood would continue to build up. Meadows and openings would shrink in size, and new openings would not be created. Aspen stands would eventually be overtopped by conifers and continue to decline, further reducing forest diversity. There would be no regeneration of new or young aspen unless a severe wildfire occurred.

Ladder fuels would remain and have the potential to carry a wildfire into the crowns of the trees. Such a fire could be carried through the dense canopy and kill most of the trees over a large area. It could take decades for the forest to reestablish, if it did at all. After such a fire, the area would be more likely to convert to brush fields or grasslands (Fleck 2011; Savage and Mast 2005).

Mistletoe would spread more easily under dense stand conditions and infestations would increase. Without the effects of cutting and prescribed fire to control mistletoe, more trees would be stunted and deformed by mistletoe. Stands would also be susceptible to insect outbreaks, particularly by bark beetles. Since the trees are dense and stressed, they would be less able to ward off an attack, and tree cover on many acres could be lost.

There would be no new economic opportunities and only small amounts of wood products would be generated.

Alternative 3

Under this alternative, about 1,900 fewer acres would be mechanically treated than under alternative 1. The effects on untreated stands would be the same as described for alternative 2. The effects on treated stands would be the same as described under alternative 1 (proposed action). In the remainder of the area, the effects from prescribed fire would be similar to those under alternative 1.

Alternative 4

The areas that are treated with prescribed fire would receive the benefits of fire as described for alternative 1. In the mechanical treatment areas, the forest structure would be the same as alternatives 1, 3 and 5, with groups of trees and spaces and trees of all sizes. The amount and type of wood products produced would also be about the same as alternatives 1, 3 and 5.

The slash treatment would result in different effects on fire behavior and forest ecology in areas that are only mechanically treated because the slash is not burned. Instead of using prescribed fire, slash could be chipped, shredded, or masticated. The effects of these types of slash treatments are just now being studied and we are not certain about the results. Based on this research, mechanical treatment of slash may have the following effects:

- Severe soil damage may occur if a fire burns when the soil is dry, or if there is a deep fuel bed (branches, twigs, needles, masticated material). There may be less damage if burning is done on wet soils. Trees may die from scorch (needles and bark are injured by excessive heat) or by overheating the roots (Busse et al. 2005; JFSP 2009; Reiner et al. 2012).
- Flame length, rate of spread, torching, and the risk of crown fire may be reduced after mastication, but surface fires may be more difficult to control (Reiner et al. 2012).

The research is not consistent, but overall it appears that mastication can reduce fire hazard by putting all of the woody material on the ground, which reduces fuel ladders. A deep bed of chips could slow the nutrient recycling process, resulting in slower tree growth. This chip layer could also suppress the growth of grasses and other understory plants There would also be few, if any, areas of bare soil to serve as seed beds for new trees. There would also be fewer acres of aspen regeneration, as aspen would have a difficult time sprouting or suckering through the chip layer.

Fire and fuels managers on the Santa Fe National Forest have experience with the effects of mastication on fuels and fire behavior. Mastication does not stop a wildfire from burning through an area and in some situations, results in a hotter fire with more severe effects.

To some extent, mechanical treatments can take the place of fire. Mechanical treatments alone can change the stand structure and reduce fire hazard, but they cannot produce the other ecological effects of fire: patchiness, an abundant understory, and animal species richness (McIver et al. 2012). For more information on the effects of slash treatment, see the fuels section of chapter 3 and the fuels specialist report.

Alternative 5

The effects are similar to alternative 1, except in Mexican spotted owl protected activity centers, target/threshold habitat, and protected habitat. Some of this difference results from the diameter cap (trees larger than 9-inches diameter would not be cut in Mexican spotted owl protected activity centers) and lack of prescribed fire in core areas. This alternative produces the highest volume of wood products because more acres in “restricted” owl habitat are treated.

Tree density as measured by basal area and trees per acre would be higher after treatments than under alternative 1 in PACs, target/threshold, and protected habitat. This is due to the diameter cap and higher basal areas in the forest plan. Values for other habitat strata are the same as alternatives 1, 3, and 5. This higher density could increase the fire hazard and risk of an insect outbreak. With these denser stand conditions, trees would not be able to grow as large as under alternative 1. Target/threshold stands would be thinned or maintained at a higher basal area- 150-170 instead of 120. This is fairly dense and trees would be competing with each other and so would not grow as well. There would be a minimal understory.

Forest Plan Amendments

The amendment regarding the development of viewshed corridor plans would have no effect on forestry activities. The amendment regarding paired monitoring of protected activity centers would have no effect on forest stands.

The other proposed amendments would have beneficial effects on forest stands:

- Allowing prescribed fire in Mexican spotted owl core areas would reduce fire hazard in these areas and allows the positive effects of fire to occur on more acres.
- Allowing more comprehensive vegetation treatments in protected activity centers would reduce fire hazard and allow some restoration activities that would preserve these areas, on more acres.
- Using the direction regarding diameter size and basal area in the revised MSO recovery plan would help us meet the objectives of growing bigger trees faster and reducing fire hazard.
- Removing trees of all sizes instead of thinning from below would allow us to create more balanced, uneven-aged stands by removing small and medium-size trees.
- Clarifying the language for interspaces in goshawk stands would clarify the intent of the desired condition for goshawk habitat.
- Allowing activities during wildlife breeding seasons and conducting surveys in peregrine falcon nesting habitat would allow us to reach our restoration goals sooner.
- Changing the visual quality objective in the Jemez National Recreation area would allow restoration work to occur in an area that needs restoration.

Cumulative Effects

Projects and activities considered in the cumulative effects analysis are listed in appendix B. Past tree cutting, grazing, and fire suppression have created a forest that is unnaturally dense. Currently, the Valles Caldera National Preserve and neighboring districts and national forests (Carson and Cibola) are also doing restoration work, including mechanical treatments and prescribed fire. There is also thinning on some of the adjacent private land. Overall, cumulative effects are minor.

Conclusion about the Effects of the Treatments

This section answers the analysis questions and how well the alternatives address the purpose and need.

Would the mechanical treatments restore spatial patterns, processes, resiliency, structure, and species composition in ponderosa pine and dry mixed conifer types?

Alternatives 1 (the proposed action) and 5, takes us the furthest toward restoration and meeting the purpose and need of this project regarding ecosystem health and resiliency. Although the VSS classes would not be completely balanced as described in the forest plan, they would be greatly improved and close to the desired condition. The proposed treatments would achieve the following:

- Initiate treatments that move much of the forest from an even-aged condition toward the desired uneven-aged structure and set up the forest to be more self-sustaining.
- Manage existing uneven-aged stands toward the desired uneven-aged forest structure proportions and provide more structural diversity
- Create a mosaic of forest types across the landscape, including old growth, meadows, and aspen stands.
- Protect habitat for the northern goshawk, Mexican spotted owl, and Jemez Mountains salamander from uncharacteristically severe wildfire.
- Reduce the potential for uncharacteristically severe wildfire by reducing stand density and ladder fuels.
- Provide economic opportunity through the commercial use of forest products.

The differences between alternatives 1 and 5 are related to the number of acres treated in target/threshold habitat or nest/roost habitat and restricted or recovery habitat. Please see the vegetation specialist report for details. Mechanical treatments reduce tree densities more and create a more balanced age class distribution alternative 1 and so the beneficial effects would last longer. The heavier treatments also create better conditions for growing large trees because of the lower density.

Alternative 2 leaves the forest overstocked and vulnerable to disturbances, such as insect outbreaks. There is a high probability of an uncharacteristically severe fire. Wildlife habitat would decline in quantity and quality, both for rare and common species. This is the least desirable alternative.

Alternatives 3 and 4 also improve ecosystem health and resiliency, but to a lesser extent than alternative 1. Alternative 3 achieves the results described above, but on slightly fewer acres.

Alternative 4 restores forest structure on all the mechanically treated areas, which reduces fire hazard to some degree. This alternative, however, does not restore the beneficial processes of fire on the mechanically treated acres. Alternative 4 would require us to treat slash some other way. We would probably use mastication, which can have negative effects on the remaining trees, soils, and the understory vegetation.

Wildlife, Fish, and Rare Plants

The following reports are incorporated by reference: threatened and endangered species (Amy and Sanchez 2013); management indicator species and migratory birds (Sanchez and Wargo 2013), and sensitive species (Sanchez and Orr 2013). See these reports for detailed information on data sources, methodology, assumptions, and limitations. This section briefly summarizes detailed information from the Southwest Jemez Mountains Landscape Assessment Report (USFS 2010), which describes existing conditions and ecological departures from desired conditions. It also briefly summarizes detailed information in resource specialist reports such as the vegetation report located in the project record. The cumulative effects disclosures for threatened, endangered, and proposed species rely in part on information in the Biological Assessment, found in the project record.

This section of chapter 3 describes the affected environment and the effects of the alternatives on wildlife species as follows: (1) federally listed as threatened or endangered under the Endangered Species Act (table 26); (2) listed sensitive by the Southwestern Region regional forester; (3) classified as management indicator species (MIS) under the Santa Fe National Forests Land and Resource Management Plan; and (4) analyzed under the Migratory Bird Treaty Act. Each category has its own requirements and standards for analysis.

Affected Environment- Threatened, Endangered, and Proposed Species

This following analysis focuses on disclosing the potential effects of the alternatives on threatened, endangered, and proposed species and their critical habitats. The determination of effects for each species was determined by evaluating the expected outcome of implementing project design features, mitigations, and Best Management Practices (BMPs) for the project listed in appendix A.

Threatened, Endangered, and Proposed Species

A biological assessment (Amy and Sanchez 2013) was prepared for this project and can be found in the project record. This section of chapter 3 will address effects on the following categories of species:

- Federally listed species: (1) Mexican spotted owl (threatened) and its designated habitat, and (2) Jemez Mountains salamander (endangered) and its proposed critical habitat
- Proposed species: (1) New Mexico meadow jumping mouse and its proposed critical habitat, and (2) wolverine (proposed 10 (j))
- Candidate species: (1) Western yellow-billed cuckoo; (2) Rio Grande cutthroat trout, and (3) Canada lynx

Table 38. Federal threatened, endangered, and proposed species analyzed

Species and Latin Name	Where is it Found?	What is the Status of the Species?	Is There Designated Critical or Proposed Habitat in the Project Area?	Is the Species Known to Occur in Project Area?
Mexican Spotted Owl (*Strix occidentalis lucida)*	Mixed conifer and associated forests; nests in mature forests	Threatened	Yes	Yes
Jemez Mountain Salamander (*Plethodon neomexicanus*)	Mesic (wet) conifer forests, wet understory	Endangered	Yes	Yes
New Mexico Jumping Mouse (*Zapus hudsonius luteus*)	Open wet meadow, riparian complex, sedges, emergent water	Proposed	Yes	Yes
Wolverine (*Gulo gulo luscus*)	Tree line, high elevation	Proposed	No	No
Western Yellow Billed Cuckoo (*Coccyzus americanus occidentalis*)	Cottonwood galleries	Candidate	No	No
Rio Grande Cutthroat Trout (*Oncorhynchus clarkii virginalis)*	Streams occupied by nonnative fish; genetically pure populations are found in isolated headwaters	Candidate	No	Yes
Canada Lynx (*Lynx canadensis*)	High elevation spruce forests; may migrate from Colorado	Candidate	No	No

Description of the Project Area

Ponderosa pine is the predominant forest type in the area, followed by piñon-juniper woodland, mixed conifer, and small patches of spruce-fir and aspen at higher elevations. The less represented habitat types are riparian areas, streams, wet meadows, seeps and springs, and aspen stands. These environmental communities are critical to some species that are dependent on one or more of these habitat types at least once in their life history.

The tree canopy is overly dense, nearly all of it is closed-canopied, so it is lacking in the canopy gaps and openings needed to support understory plants. The ponderosa pine forest covering most of the project area is dominated by small to mid-size trees 3 to 12-inches diameter, uncharacteristically dense and homogenous. There is a lack biological diversity needed for quality wildlife habitat, and the area does not support the surface fires typical of southwestern ponderosa pine forests. Historical meadows, aspen patches, and riparian vegetation have also greatly diminished from pre-settlement conditions because of conifer encroachment in the absence of a frequent surface fire regime.

Fire frequency and fire behavior have changed also, with the greatest changes occurring in the dry forest types- ponderosa pine and dry mixed conifer (Covington and Moore 1994; Arno et al. 1997). Fire exclusion and past land management practices have led to dense forest canopies with high levels of surface and ladder fuels. As a result, there is an increased potential for uncharacteristically severe wildfires. Instead of high frequency, low-intensity surface fires, the conditions of the dry forests we find today are more likely to support crown fires (Scott and Reinhardt 2001).

Please refer to the fuels and vegetation specialist reports and sections of chapter 3 for more details on fuels, fire regimes, and forest conditions.

Affected Species and Critical Habitat

Mexican Spotted Owl

The forest plan standards and guidelines for the Mexican spotted owl (MSO) would be amended where appropriate under alternatives 1, 3, and 4 to meet the purpose and need of the project (see table 1). The natural history and distribution of the owl is covered in detail in the original and revised Mexican spotted owl recovery plans (USFWS 1995; 2012). Since the revised recovery plan was published, no information on the natural history or distribution of the owl has changed. We incorporate these recovery plans by reference. The project area is within the Southern Rocky Mountains–New Mexico Recovery Unit for the owl, which covers the Santa Fe National Forest (USFWS 1995; 2012).

In the Jemez Mountains, many owls are found in the rocky canyons that cut into volcanic tuff at lower elevations. These canyons provide many potholes, ledges, and small caves that the owl uses for roosting and nesting. The canyon habitat often has mature Douglas-fir, white fir, and ponderosa pine in canyon bottoms and on the north- and east-facing slopes. Rocky cliffs and canyon rims can modify the amount of sunlight reaching the inner-canyon habitats, so that vegetation communities and microclimates may vary greatly (USFWS 2012).

Nesting and roosting habitat for the owl is regarded as mature and old growth mixed conifer forest with a relatively closed canopy and a complex, uneven-aged structure (USFWS 1995). Forage or prey species habitat occurs where there are openings in the tree canopy and the owls can see their prey: wood rats, deer mice and voles (Ward 2001). Forage habitat is sorely lacking in the project area and should include high numbers of fallen trees and logs and a diversity of tree and plant species (USFWS 1995; 2005).

The greatest threat to Mexican spotted owl habitat in the project area is the high potential for a large, uncharacteristically severe wildfire similar to the 2011 Las Conchas fire. Human-managed alteration of forests in the Southwestern U.S. has resulted in extensive areas of Mexican spotted owl habitat that is now more vulnerable to the effects of stand-replacing wildfires. Other key problems affecting the owl habitat in this area are the lack of large, mature trees and lack of small forage openings.

Population trends for the owl remain unclear across its range. The Southern Rocky Mountain Ecological Management Unit has 74 Mexican spotted owl sites located in Colorado and Northern New Mexico, including the Jemez Mountains. Population trends in New Mexico appear to be declining slightly, but the population on the Santa Fe National Forest appears stable (USFS 2012), though the forest experienced large areas of habitat loss due to the Las Conchas fire in 2011.

Mexican spotted owls appear to use a wider variety of cover types for foraging than for roosting or nesting. Nesting and roosting habitat is defined as mature and old growth mixed conifer forest with a relatively closed canopy and a complex, uneven-aged structure (USFS 1996).

The forest plan calls for managing mixed conifer forests toward irregular tree spacing and various patch sizes; horizontal structural variation with natural canopy gaps; species diversity with all species of native trees represented including early seral species; at least 3 snags, 5 downed logs, and 10 to 15 tons of woody debris per acre. The primary constituent elements are described in detail in the biological assessment; the main features are: forest structure, maintenance of adequate prey, and canyon habitat. Current conditions do not meet reference conditions identified in the recovery plan (USFWS 1995) primarily due to the lack of structural and vegetative species diversity, large trees, and understory plants.

The 1995 recovery plan defines three types of owl management habitat areas: (1) protected habitat consisting of protected activity centers (PACs), which are occupied nesting and roosting areas of about 600 acres around the nest site; and areas outside of PACs containing mixed conifer forest on slopes over 40 percent where timber harvest has not occurred in the last 20 years[32]. Also, within each PAC, a 100-acre core area is designated around the nest site. About 2,900 acres are designated as PACs; (2) restricted habitat consists of mixed conifer forest on slopes less than 40 percent outside of a PAC. The restricted habitat does not meet the desired condition for MSO based on the forest plan, because it is lacking large trees and should have at least 20 trees per acre over 18-inches in diameter; and (3) threshold habitat, which consists of a minimum percentage of the restricted habitat managed for nesting and roosting characteristics over time.

There are 6 PACs in the project area. Survey results and the establishment dates for these PACs are shown in table 39.

Table 39. Year of establishment and survey results for the six PACs in the project area. No responses have been detected in four PACs recent years

PAC Name	Year Established	Survey Results
Hummingbird	1992	Two surveys have been conducted since 2003 (2008 and 2013) with no response detected.
Lake Fork	2009	Owls were detected in 2009. There was no response to surveys in 2013.
Paliza	2006	No response to surveys conducted each year from 2007 through 2013.
San Juan	2004	One unidentified individual detected in 2005. No response to surveys conducted in 2009 and 2013.
Virgin	1989	This PAC was determined to be occupied from 1990 through 1996 and again in 2003. No response to surveys conducted in 2009 and 2013.
West Mesa	1998	PAC was determined to be occupied in 1992, 1995, and again in 2008. There was no response to surveys in 2013.

[32] Classification of mixed conifer on the Santa Fe National Forest requires that only 20 percent of the dominant overstory trees consist of mixed conifer species, which differs from how mixed conifer is defined in the Forest Service FSVeg database. Thus, some designated protected habitat consists of predominantly ponderosa pine.

Western Yellow-billed Cuckoo

In the Southwest, the yellow-billed cuckoo is usually found in mature riparian cottonwood-willow woodlands and dense mesquite associations. These birds prefer areas with a closed canopy and a sub-canopy layer (USFS 2011).

The main threats to this bird are loss of riparian habitat from conversion to farmland, dams and river flow management, stream channelization and stabilization, and livestock grazing. The replacement of native riparian habitats by invasive nonnative plants, particularly tamarisk has affected breeding habitat.

In New Mexico, the Western yellow-billed cuckoo is currently restricted to the San Juan, Rio Grande, Pecos, Canadian, San Francisco, Mimbres, and Gila River valleys (USFWS 2011). On the forest, the Western yellow-billed cuckoo is generally restricted to the Rio Grande and its tributaries. Populations of the Western distinct population of the yellow-billed cuckoo may exist on the Jemez and Española Ranger Districts, but the cuckoo is not known to occur in the project area. There are about 632 acres of potential cottonwood habitat for the cuckoo on the Forest; a total of 7 acres is along the Jemez River. Most of the cuckoo habitat on the forest is found along the Rio Grande, Pecos, and Jemez Rivers.

Jemez Mountains Salamander

The Jemez Mountains salamander is native to north-central New Mexico and is only found in the Jemez Mountains in Los Alamos, Rio Arriba, and Sandoval Counties. This lungless salamander is found primarily in mixed conifer habitats that have abundant rocks and surface logs, especially on steep north-facing slopes. These habitats are relatively moist and have soils that contain deep igneous subsurface rock that is fractured (has cracks). The fractures allow the salamander to retreat below the frost line. These salamanders spend most of their life underground, and are active on the surface during a brief period of the summer when conditions are warm and wet. Even then, they stay inside rotted coniferous logs or under rocks. The humidity and moisture level at and below the surface is probably the most important ecological factor of this species. It needs a moist environment because it breathes through its skin.

Approximately 75 percent of their diet includes ants; other prey items include beetles, mites, spiders, earthworms, and other small invertebrates (USFWS 2012b). There is no aquatic life stage for this salamander. Activity above the ground is likely associated with summer monsoon rains.

A full description of threats to the salamander is found in the proposal for listing (USFWS 2012), which is incorporated by reference. The primary threats are: historical fire exclusion (the act of preventing fire) and suppression; uncharacteristically severe wildfire; changes in and conversions of forest composition and structure; forest and fire management; post-wildfire rehabilitation; residential development; roads, trails, habitat fragmentation; recreation, and climate conditions.

Nearly all of Jemez Mountains salamander habitat is on federally-managed lands. The project area contains about 21 percent of the critical habitat for the species, though not all of that is suitable habitat. Much of the critical habitat around the San Antonio southwest of the Valles Caldera appears to be unsuitable because numerous surveys have not found salamanders.

The salamander has been on the Regional Forester's Sensitive Species list since 1990. In 2000, the interagency New Mexico Endemic Salamander Team finalized a conservation plan for the salamander. In 2012, the U.S. Fish and Wildlife Service (USFWS) proposed to list the salamander as endangered, and it was listed in September 2013. The Fish and Wildlife Service amended the proposed critical habitat designation and modified some of the primary habitat elements in 2013. These elements include moderate to high tree canopy cover, moderate to high volumes of large fallen trees and other woody debris at least 10- inches diameter, and underground habitat in forest or meadow areas with spaces made by fractured rock, rodent burrows, or rotted tree root channels.

Long-term population trends are not known because most surveys have only determined the presence or absence of the species (USFS 2011). Recent numbers of individuals seem to be much lower than numbers reported in 1970, and there appears to be a decreasing trend in areas that used to be occupied (75 FR 54822; September 9, 2010). Detecting overall trends is difficult for this species because of data limitations, the cost of comprehensive surveys, and the likelihood of natural, annual, and spatial variations (77 FR 56482, September 12, 2012).

The project area has 32 occupied sites, some of which were burned during the Las Conchas fire and nearly 11,800 acres of proposed critical habitat. Four of the occupied stands are planned for treatments, including prescribed fire. These stands are in the ponderosa pine forest type and cover 131 acres. About 10 percent of the known occupied sites would be treated with prescribed fire, and only about 0.03 percent would be treated by removal of ladder fuels and prescribed fire across the species range. A total of 15 occupied stands are planned for prescribed fire treatment. No activities are planned in the portion of the proposed critical habitat that burned in the Las Conchas fire.

Canada Lynx

In 2009 the Fish and Wildlife Service listed the lynx as a distinct population segment in New Mexico because it was documented in the state as a result of a reintroduction effort in Colorado. Lynx released in Colorado drifted into New Mexico, and these animals are not considered essential to the survival or recovery of the lynx. The Canada lynx is not known to occur in the project area. The threats to the lynx in New Mexico from human-caused mortality are low and are not a significant threat. The amount of suitable habitat for lynx in the state is considered marginal relative to the amount of habitat within the species range.

New Mexico Meadow Jumping Mouse

The jumping mouse is a habitat specialist that nests in dry soil but also uses tall, dense, herbaceous riparian vegetation (Frey 2007). Its habitat is limited to riparian wetland habitats with plants that are at least 24-inches high. The jumping mouse needs this vegetative cover for movement, nesting, or burrowing. Other key habitat features are extensive channels, ponds, shallow flooded areas, and other similar wet habitats created by beavers.

Threats to the mouse are related to habitat. Risk factors include excessive grazing pressure from livestock, water use and management, highway reconstruction, development, and recreation. These activities reduce or destroy the tall vegetation and wetland or riparian habitat needed by the mouse and influence species persistence across the landscape.

The New Mexico meadow jumping mouse was proposed for listing as an endangered species along with critical habitat in June 2013. The critical habitat encompasses historical jumping mouse locations along the San Antonio, Rio Cebolla, and Rio de las Vacas on the Jemez and Cuba Ranger Districts. There are 3 areas or subunits of critical habitat in the Jemez Mountain Range. For planning purposes, we have identified 2,167 riparian acres in the project area as potential jumping mouse habitat in the analysis. The San Antonio watershed was identified as having potential habitat for the species and it is a priority watershed for restoration (USFS 2012).

Wolverine

In North America, wolverines are found within a wide range of alpine, boreal, and arctic habitats. They favor areas that are cold and receive enough winter precipitation to maintain snow into the warm season. They generally occur in high ridgetop mountainous areas. The wolverine is not known to occur in the project area.

The wolverine in northern New Mexico was proposed as a nonessential experimental population (USFWS 2013). It has been proposed for Federal listing as a threatened species in the Sothern Rockies. The proposed rule published in the federal register (Federal Register 2013) provides a plan for establishing nonessential experimental population areas and allows for legal incidental take of the wolverine in these areas.

Rio Grande Cutthroat Trout

Rio Grande cutthroat trout are found primarily in clear, cold mountain lakes and streams at elevations above 6,000 feet in Colorado and New Mexico within the Rio Grande Basin (Sublette et al. 1990). In New Mexico, this trout lives mostly in mountain streams in the Sangre de Cristo and Jemez Mountain ranges on the Carson and Santa Fe National Forests. Isolated populations are found in southern New Mexico. Side channels, undercut banks and overhanging vegetation or exposed roots along the streams provide habitat for juvenile fish. Adult fish need pools deeper than 1 foot in order to survive harsh winter conditions (Harig and Fausch 2000).

The biggest threats are habitat loss and interbreeding. The historical range of Rio Grande cutthroat trout has been greatly reduced over the last 150 years because of water diversions, stream drying, dams, habitat degradation, and changes in hydrology. Interbreeding with rainbow trout and competition with brown and brook trout have also reduced populations (Pritchard and Cowley 2006). Also, ash and debris flows that occur after wildfires can eliminate populations of fish from a stream (Rinne 1996; Brown et al. 2001; USFS 2006; Patten et al. 2007). On the Santa Fe National Forest, four conservation populations were lost to wildfires in 2010 and 2011.

The Rio Grande cutthroat trout is a Forest Service Southwestern Region Sensitive Species and is managed by the New Mexico Department of Game and Fish as a protected species. It is also considered a species of greatest conservation need[33] (NMGF 2006). In 2008, Rio Grande cutthroat trout was listed as a candidate for federal protection under the Endangered Species Act.

As of 2011, 44 conservation populations had been identified on the Santa Fe National Forest, totaling 128.7 miles of occupied stream (SNF 2012). These populations tend to be in small, isolated segments of stream high up in the backcountry in both the Pecos and Jemez areas.

There are no conservation populations in the project area, but four streams in the project area are stocked with surplus hatchery fish: East Fork Jemez River, San Antonio Creek, Rio Cebolla, and

[33] These are species that are indicative of the diversity and health of the state's wildlife that are associated with key habitats, including low and declining populations, and species of high recreational, economic, or charismatic value.

Rio Guadalupe. They are considered experimental populations and have been found in very low numbers.

Methods

This analysis used the best available information and included habitat variables such as vegetation, slope, and elevation. Potential habitat is based on the presence of habitat characteristics as described in available scientific literature, previous wildlife surveys, recorded wildlife observations, and from other credible sources of natural biotic information.

The Santa Fe National Forest has developed spatially defined databases that include variables related to forest structure, forest health, and the information listed above. This analysis does not represent all occupied habitat for the species addressed here, only potential habitat and then only based on the available information for the physical and biological attributes available in current forest databases. This provides a means to compare existing conditions with the alternatives in a quantitative manner. The timeframe for this analysis is 10 years from the proposed implementation date of 2014.

The following indicators were used to measure project effects on species habitat:

- Vegetation- potential changes in forest structure and composition
- Acres of occupied or potential habitat
- Stream miles treated
- Road miles

Summary of Effects

Effects of the proposed action on threatened, endangered, and proposed species and critical habitats are described below. Conservation measures that would avoid or minimize effects are found in appendix A and in the biological assessment, which is in the project record.

Mexican Spotted Owl

Alternatives 1, 3, and 4 may result in short-term, adverse effects on the Mexican spotted owl and its designated critical habitat. These effects would result from changes in forest structure associated with mechanical treatments and prescribed fire. Management guidance from the 2012 revised recovery plan would be used and will likely improve vegetative diversity, which should improve prey abundance and availability for the owl. In the long term, the proposed action would reduce the potential for degradation or loss of Mexican spotted owl critical habitat from an uncharacteristically severe wildfire. Under alternative 5, effects on the owl are likely to be discountable and insignificant due to the more restrictive management guidance in the forest plan. Alternative 5 would not likely result in adverse effects on the owl.

Project related activities may impact individuals through changes in habitat quality. Short term impacts will likely result in long-term benefits to the species through building habitat resilience to large high severity wildfire. It is difficult to quantify the number of individuals that may be disturbed by project activities because individuals not paired for breeding are difficult to find.

Alternative 1 would likely provide better resilience to severe wildfire than alternative 5 because the resulting forest structure would be more resilient to severe wildfire for a longer time.

Alternative 1 would also better achieve the desired forest structure and diversity as described in the revised MSO recovery plan to provide for future habitat.

Implementation of the project is expected to retain the range of tree species and size classes intended for critical habitat. Some loss of trees, of all types and diameter size classes, will occur from actions such as hazard tree removal and prescribed burning and up to 18-inches diameter from forest stand improvement thinning and mechanical treatments. Removal of tree size classes may occur as part of the development of new temporary road construction and maintenance of roads. These effects should be small in extent and intensity.

Tree canopy would be reduced following hazard tree removal, forest stand improvement thinning, prescribed burning, and mechanical treatments. Canopy cover is not anticipated to be reduced below 40 percent in groups and clumps across the project while managing for higher basal area. Reduction in canopy cover may shift or increase prey species distribution as understory vegetation reestablishes in currently high-density stands.

Prescribed fire would result in a decrease in plant cover in the short term but provide conditions suitable for increasing herbaceous plant growth long term by removing the thick layer of litter on the forest floor. As a result, critical habitat quality will improve as vegetation conditions change to favor small rodents, promoting greater prey diversity and availability.

Prescribed fire and maintenance burning treatments would likely reduce the high volume of fallen trees and woody debris affecting prey habitat. This could reduce the amount of large logs resulting in short-term adverse effects on MSO prey but as discussed above, would likely improve understory vegetation and food availability for prey species. Understory vegetation would seasonally replace cover for prey while increasing forage that will likely result in an increase of prey available to MSO during the breeding season. Some short-term loss of cover is likely to occur based on the shift in plant species.

A determination of may affect, likely to adversely affect was made for the owl and for its critical habitat for alternatives1, 3, and 4 because of short-term effects from vegetation treatments.

Western Yellow-Billed Cuckoo

Instream restoration work and riparian planting may occur in potential habitat and will likely improve conditions for riparian-dependent birds such as the cuckoo. All action alternatives (1, 3, 4, and 5) would not jeopardize the western yellow-billed cuckoo and may affect, but is not likely to adversely affect the cuckoo.

Jemez Mountains Salamander

All action alternatives (1, 3, 4, and 5) may result in adverse effect on the Jemez Mountains salamander and its designated critical habitat. These effects would stem from changes in forest structure as well as surface disturbance associated with mechanical treatments and prescribed fire, but these effects are expected to be short term. The design features and mitigation measure would minimize these effects on individual salamanders and critical habitat. The proposed action would reduce the elevated hazard of high-severity fire. The effects of the prescribed fire treatments are largely beneficial and in line with historical fire effects. Mechanical treatments would impact surface habitat, but are not anticipated to affect subsurface habitat.

A determination of may affect, likely to adversely affect was made for the salamander and for its critical habitat for all action alternatives because of short-term effects from vegetation treatments.

Canada Lynx

There is no documented detection of lynx in the project area. None of the action alternatives are likely to rise to the level of effects that would result in take of the species.

A determination of may affect, not likely to adversely affect was made for the Canada lynx for all of the action alternatives.

New Mexico Meadow Jumping Mouse

The proposed treatments under all action alternatives would move jumping mouse habitat towards recovery in San Antonio and Rio Cebolla streams systems. Effects from instream work and construction of exclosures may adversely affect the jumping mouse, but will result in long-term benefits by improving riparian vegetation and stream function. The effects will be minimized through the design features and mitigation measure listed in appendix A.

Effects from all of the action alternatives would not likely jeopardize the New Mexico meadow jumping mouse. A determination of may affect, likely to adversely affect was made for the jumping mouse and for its proposed critical habitat for all action alternatives because of short-term effects from aquatic and riparian restoration treatments.

Wolverine (proposed non-essential experimental population)

There are no documented records of wolverine present in the project area. Project activities are not expected to impact wolverine habitat.

Effects from all action alternatives would not jeopardize the wolverine.

Rio Grande Cutthroat Trout

Under all action alternatives (1, 3, 4, and 5), the riparian area restoration and instream treatments would improve habitat conditions for Rio Grande cutthroat trout in the project area. Instream work would restore or enhance key habitat components. Short-term, localized impacts could include an increase in sediment and turbidity in streams due to mechanical equipment working in or near the stream. The effects will be minimized through the design features and mitigation measure listed in appendix A.

Effects from the action alternatives would not likely jeopardize the Rio Grande cutthroat trout.

Environmental Consequences

Alternative 1

Mexican Spotted Owl

The revised recovery plan (USFWS 2012) for the owl was used to guide us in the project design and effects of the action on the owl and its habitat. It was also used to guide development of the proposed forest plan amendments (see chapter 2). The forest plan, however, is more restrictive in managing habitat for the owl. The spotted owl habitat analysis in the vegetation specialist report was also used for this effects analysis and is incorporated by reference.

Determination of effect (Species): May Affect, Likely to Adversely Affect, with long-term benefits

Determination of effects (Critical Habitat): May Affect, Likely to Adversely Affect, while providing long-term benefits

Project related activities may impact individual owls due to changes in habitat quality. Short-term impacts will likely result in long-term benefits to the species by increasing habitat resilience to large, high-severity wildfires. It is difficult to quantify the number of individual owls that may be disturbed by project activities because individuals not paired for breeding are difficult to find. It is not certain that owls are nesting and roosting in areas outside of protected activity centers (PACs) in any given year.

The following table lists potential treatments by acres within PACs and critical habitat. Not all of the acres identified will be treated, but may have the potential. As an example, there are 2,210 acres of aspen in critical habitat, but only 1,800 of aspen treatments would be treated under the proposed action, and only 414 acres within PACs are suitable for mechanical treatments.

Table 40. Type and amount of proposed treatments in Mexican spotted owl critical habitat and protected activity centers

Treatment Type	Amount in Critical Habitat	Amount in Protected Activity Centers
Aspen Enhancement	2,210 acres	43 acres
Meadow Restoration	2,232 acres	129 acres
Piñon-Juniper Treatments	936 acres	0 acres
Riparian Restoration	538 acres	235 acres
Old Growth	3,134 acres	2,604 acres
Invasive Plant Control	39 acres	0 acres
Headcuts	263 sites	48 sites
Dispersed Campsite Rehabilitation	50 sites	10 sites
Road Decommissioning	38 miles	7 miles
Mechanical Treatments	12,455 acres	401 acres
Prescribed Fire	22,365 acres	3,112 acres
Roads Used to Access Treatment Sites	177 miles	19 miles
Landings	297 sites	13 sites

Effects on the Species

The mechanical treatments are anticipated to result in minimal direct impacts on the owl. Activities in PACs would be avoided during the breeding season unless the PAC has been adequately surveyed by qualified personnel according to the most recent survey protocol approved by the U.S. Fish and Wildlife Service and determined to be unoccupied for that year.

Prescribed fire treatments could occur in all six PACs and would be used in the entire PAC area, including the core. We would not separate prescribed fire in PACs from that of the surrounding project area. This approach minimizes disturbance from fire containment actions (handline construction) and other activities that would be needed to keep prescribed fire from entering the core areas. Fire managers could use techniques to minimize burn severity (using a backing fire) within core areas while gaining the benefits of removing fine fuels within the core.

The prescribed fire treatments would result in about 15 percent mortality of trees within the PACs due to the higher percentage of fire intolerant tree species, such as white fir, within the mixed conifer stands. The effects on the owl would largely be beneficial as dead trees become snags and canopy gaps, important for maintaining diverse tree and understory species, are created. Prescribed fire is unlikely to affect nesting in the project area because the owl usually nests in rock or cliff faces. Cultural site treatments are likely to have similar effects as the prescribed fire and mechanical treatments.

Riparian treatments would move riparian corridors toward the desired function and improve connectivity for a diversity of species including prey animals for the owl.

Potential gravel pit sites have not been identified and would not be known until it can be determined if the site(s) are suitable upon implementation. Future gravel pits would not be established where effects on the owl are anticipated.

Effects on Critical Habitat

The proposed treatments would result in an overall benefit to critical habitat by enhancing riparian and meadow habitat, promoting aspen stands, and moving towards a resilient landscape, while reducing habitat loss from environmental stressors such as wildfire. See table 40 above for a list of planned treatments in critical habitat.

The mechanical treatments are expected to retain the range of tree species and size classes needed for quality critical habitat. Species and size diversity would promote cover, forage habitat, and promote recovery of the owl in the project area over the long term by increasing resiliency. Some loss of trees of all types and diameter size classes would occur from hazard tree removal, prescribed fire, temporary road construction, and road maintenance. Trees up to 18-inches diameter could be cut as part of the mechanical treatments. The effects from tree removal should be small in extent and intensity.

Tree canopy would be reduced following hazard tree removal, forest stand improvement thinning, prescribed fire, and mechanical treatments. Canopy cover is not anticipated to be reduced below 40 percent in groups and clumps across the landscape, and would be managed for higher basal areas. The reduction in canopy cover may shift or increase prey species distribution as understory vegetation reestablishes in what are now high-density stands.

Prescribed fire treatments would result in a short-term decrease in understory plant cover, but provide conditions that would increase plant growth in the long term by removing the thick layer of litter on the forest floor. As a result, critical habitat quality would improve because the change in vegetation would favor small rodents, promoting greater prey diversity and availability.

Prescribed fire and maintenance burning treatments would likely reduce the high volume of fallen trees and woody debris. This would result in in short-term, adverse effects on prey species, but as discussed above, would likely improve understory vegetation and food availability for prey species. Understory vegetation would seasonally replace cover for prey while increasing forage, and this would likely result in an increase of prey available to the owl during the breeding season. Some short-term loss of cover is likely to occur based on the shift in plant species.

Large snags are limited across the project primarily due to past harvesting that removed large trees. Prescribed fire and hazard tree removal may further reduce snag distribution across the project area, but prescribed fire is likely to create snags through tree mortality. Drought, disease, and insect infestations are other ways that may promote adequate snag densities across the landscape though the project is expected to also improve resilience to disease and insects. If snags are limited in the project area after treatments, snags may be created by using fire or other mechanical methods.

Forest Plan Amendments

Site-specific forest plan amendments are needed to implement prescribed fire and other restoration treatments within the PACs. These amendments are also needed to address the differences between the forest plan guidance for the management of Mexican spotted owl habitat and the revised MSO recovery plan (USFWS 2012), which was updated to reflect the current science.

The effects of the amendments are the same as the effects described above. The amendments are intended to facilitate restoration treatments, which are designed to implement the most current scientific information on the species and its habitat requirements. The amendments also have the effect of allowing the Forest to treat all of the PACs within the project area. Under the current forest plan, not all of the PACs within the project area could be treated without monitoring to determine the effects of the treatments before treating all of the PACs. This was an issue also addressed in the revised recovery plan for the owl as recovery units were broadened to encompass larger areas.

ESA Cumulative Effects

Cumulative effects under the Endangered Species Act joint regulations are those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area subject to consultation. Non-National Forest System lands within the project area total about 13,836 acres: Jemez Pueblo- 3,845 acres; State- 281 acres, and private or other lands- 9,710 acres. No treatments are proposed on non-national forest land. The Forest is not aware of any major actions proposed on State or private lands, though ongoing activities in subdivisions, private and State road maintenance, private mining activities, and recreation may increase disturbance and influence quality or quantity of Mexican spotted owl habitat on those lands.

Western Yellow-Billed Cuckoo

Determination of Effect (Proposed Species): Not Likely to Jeopardize

Determination of Effect (if listed): May Affect, Not Likely to Adversely Affect

Critical Habitat: Not applicable

Approximately 630 acres of potential habitat were identified on the Santa Fe National Forest. Seven acres (about 1.1 percent) is in the project area along the Jemez River. Riparian and instream habitat treatments may occur in cuckoo habitat. Instream restoration and stabilization and riparian planting may occur in potential habitat as part of the project but are expected to be minimal in the cottonwood galleries. Project activities are not likely to affect the cuckoo.

Site-specific forest plan amendments will likely have no effect on the Western yellow-billed cuckoo as the areas for which the amendments apply do not overlap in time or space with cuckoo habitat. The amendments pertain to woodland and cliff-swelling species, (peregrine falcon), or changes in management for visual quality and would not affect cuckoo habitat.

ESA Cumulative Effects

Much of the habitat along the lower Jemez River where potential cuckoo habitat exists is privately owned. The Forest is not aware of any plans to further develop these lands or of other State actions that may cumulatively affect the cuckoo.

Jemez Mountains Salamander

Determination of Effect (Species): May Affect, Likely to Adversely Affect

Determination of Effect (Critical Habitat): May Affect, Likely to Adversely Affect

Table 41 displays the type and amount of treatment planned for salamander critical habitat. No temporary roads would be constructed in salamander critical habitat. Not all acres identified in in the table would receive treatment. For example, only about 10 acres of aspen treatments would occur in critical habitat, but over 3,000 acres are available for such treatments. This is also true for headcut, riparian, and meadow treatments. Most of the acres being treated with mechanical treatments and prescribed fire would receive treatment.

Table 41. Amount and type of proposed treatments in Jemez Mountains salamander critical habitat

Treatment Type	Amount in Critical Habitat
Aspen Enhancement	3,322 acres
Meadow Restoration	553 acres
Piñon-Juniper treatments	0 acres
Riparian Restoration	592 acres
Salamander Habitat Enhancement	131 acres
Old Growth	1,592 acres
Invasive Plant Control	29 acres
Headcut Treatments	159 sites
Dispersed Campsite Rehabilitation	7 sites
Road Decommissioning	6 miles
Mechanical treatments	3,709 acres
Prescribed fire	11,724 acres
Roads Used to Access Treatment Sites	83 miles

Treatment Type	Amount in Critical Habitat
Landings	152 sites

Effects on the Species

The proposed mechanical treatments are expected to result in impacts on surface habitat, but these impacts are not anticipated to effect subsurface habitat where the species likely lives most of the year. Effects on surface habitat would result from movement of some surface rocks and changes in down log availability and abundance. Existing down logs would be avoided as much as possible. Occupied stands fall within designated critical habitat and would receive different mechanical treatments (see below).

Control of invasive and nonnative plants would promote a healthier habitat for wildlife but could have adverse effects if conducted during the monsoon season when salamanders are at or near the surface. The areas with these plants are small, and areas along roads are not suitable salamander habitat, so effects on salamanders are likely to be minimal. These plants, however, may reduce the quality of salamander habitat, adversely affecting microhabitat and controlling the spread and establishment of these plants would have a positive effect in the long term.

Occupied Stands

Of the 15 occupied stands, four that would receive a “light” treatment: remove of trees less than 20 feet tall, limbing of trees up to 6 feet, piling and burning the slash. The remaining six stands would be treated the same way surrounding stands are treated. Five stands would not be treated. All 15 stands would be treated with prescribed fire when the surrounding area is burned. Fire would not ignited in occupied stands, but prescribed fire would be allowed to back into them.

The effects of prescribed fire are largely beneficial as dead trees become snags and future down logs. Canopy gaps promote both tree diversity and understory plant species that improve resiliency to landscape level disturbances such as disease and severe wildfire.

Cultural site treatments would also have effects on salamanders. Removal or selective placement of large downed logs at archeological sites could cause displacement of individuals. The potential for sites at high elevations, especially above 9,000 feet, is considered low; most of the known sites are in dry locations on higher flat areas on mesas.

Prescribed fire would occur including critical habitat and occupied stands. This approach minimizes disturbance from fire containment actions (construction of fire control lines) and provides flexibility for fire managers to minimize burn severity in sensitive areas such as occupied salamander stands. Preparation of fire control lines prior to prescribed fire, whether using mechanical methods or hand-crews, may cause direct mortality of some individuals. The likelihood of this occurring is very small. Fire crews would be instructed to avoid old logs and stumps and control line preparation is not likely to take place during the monsoon season with the potential exception of hand thinning.

Pile burning would be conducted when conditions are cool and dry or during the winter months when snow is present on the ground and salamanders would not be present at or near the surface. The heating of the soil is unlikely to affect salamanders when conditions would be suitable for burning as described above. A study on pile burning concluded that burning of hand-built piles of various sizes and fuel types did not cause extreme soil temperatures unless large wood was the dominant fuel type (Busse et al. 2013).

Potential gravel pit sites have not been identified and would not be known until it can be determined if the site(s) are suitable upon implementation. Future gravel pits would not be located in critical habitat or suitable salamander habitat. Before gravel pits are established, sites will be assessed for potential salamander habitat and surveyed at the appropriate time of year and climate conditions to determine suitability or occupancy.

See appendix A for design features, best management practices, and mitigation measures that would minimize or avoid effects on salamanders.

Effects on Critical Habitat

Creating a more resilient landscape would reduce the threat of wildfire to critical habitat and prevent loss of habitat elements such as down logs and snags. Reducing the elevated hazard of high-severity fire would reduce salamander mortality from excessive drying of the soil due to the total loss of canopy cover. This loss of canopy cover would occur in a stand-replacing fire. Reducing tree density overstocked stands would decrease evaporation of snow from tree branches and improve the surface snow pack and improve infiltration of water into the soil (Hedstrom and Pomeroy 1998; Hood et al 1999; Storck et al 2002). Higher soil moisture following snow-melt would improve salamander habitat conditions into early summer and reduce the time of low moisture availability between snowmelt and the start of the monsoons. Ultimately, moisture is dependent on climatic conditions and climate change may reduce snowfall and worsen drying of habitat.

The mechanical treatments would reduce tree canopy coverage, allowing more sunlight to reach the ground. Understory vegetation would increase over the long term, but in the short term, there may be short term drying of the soil until understory vegetation is established. Some areas of habitat may experience periods of increased warmth and dryness, which would influence salamander activities and microhabitat distribution. This effect could be offset by increases in the snowpack as described above. Regardless, a treated forest would provide year-round shade as compared to the deciduous shading provided by shrubs that grow after a stand-replacing fire.

Mechanical treatments would leave most of the existing down wood logs and stumps but prescribed fire would likely reduce log and stump availability. Additional logs from thinning treatments and cutting of hazard trees may also improve log recruitment.

Machinery and other equipment may cause direct mortality of salamanders by crushing and compacting the soil or surface rocks where salamander maybe sheltering. This impact is likely minimal because heavy equipment would be used when conditions are dry and salamanders are not likely to be at the surface.

The use of hand crews to reduce ladder fuels in occupied stands would reduce the chance of injury or mortality to individual salamanders as compared to machinery. Mortality is not likely because prime microhabitat sites (logs, stumps, and rock piles) would be avoided, and some sites may be too dry for salamander use.

Road closure and rehabilitation may reduce any ongoing road impacts on surrounding salamander habitat. Road maintenance would have no significant effect because it occurs in the existing road footprint, which is not suitable habitat. Road treatments would likely reduce sediment runoff.

Riparian zones, seeps, springs and wetlands are generally not suitable salamander habitat, as salamanders generally do not directly occupy riparian zones. Nearby offsite logs and stumps at the edge of riparian zones, however, may provide suitable microsites.

ESA Cumulative Effects

Cumulative effects under the Endangered Species Act joint regulations are those effects from future State or private activities, not involving Federal activities that are reasonably certain to occur within the project area of the Federal action subject to consultation. The ongoing activities in subdivisions, roads, mining, and recreation, may increase disturbance and influence quality and quantity of habitat on State and private land.

Canada Lynx (All Action Alternatives)

Determination of Effect (Proposed Species): Not Likely to Jeopardize

Determination of Effect (if listed): May Affect, Not Likely to Adversely Affect

Critical Habitat: Not applicable

Recovery Plan: Not applicable

There is no documented detection of lynx in the project area. None of the action alternatives are likely to rise to the level of effects that would result in take of the species.

New Mexico Jumping Mouse

Determination of Effect (Proposed Species): Not Likely to Jeopardize

Determination of Effect (if listed): May Affect, Likely to Adversely Affect

Determination of Effect (Proposed Critical Habitat): May Affect, Likely to Adversely Affect

Effects on the Species and Proposed Critical Habitat

The riparian plant species needed to support habitat for the jumping mouse are limited or absent. Treatments would likely move jumping mouse habitat toward a desired condition and function for the species' recovery in San Antonio and Rio Cebolla streams systems. Proposed treatments to enhance riparian areas, the instream habitat work, and exclosures would improve jumping mouse habitat.

Riparian and channel restoration may result in short term impacts on the mouse by disturbing ground in riparian areas to promote willow and other woody riparian vegetation growth. Long-term effects are anticipated from project activities as they are intended to improve riparian vegetation and restore wetlands by improving floodplain connectivity. Instream channel restoration actions would generate short-term increases in sediment and turbidity in sections of the stream downstream of the activity.

Wolverine

Determination of Effect: Not Likely to Jeopardize

There are no documented records of wolverine present in the project area. Project activities are not expected to impact wolverine habitat.

Rio Grande Cutthroat Trout

Determination of Effect (Proposed Species): Not Likely to Jeopardize

Determination of Effect (if listed): May Affect, Likely to Adversely Affect, and may benefit.

Critical Habitat: Not applicable

Recovery Plan: Not applicable

The proposed riparian area restoration, aquatic habitat improvement, and instream treatments would improve habitat conditions for the trout in San Antonio Creek, Rio Cebolla, East Fork of the Jemez River, and the Rio Guadalupe. All streams are currently lacking key habitat components, including quality pool habitat. Streams are too wide and shallow. Many streams also have an overabundance of fine sediment, bank erosion, and a lack of large woody debris (Landscape Assessment, 2010). In addition, several reaches are downcut, and as a result, the streams are no longer connected to their floodplain. This connectivity helps to dissipate large flood and runoff events.

Aquatic habitat improvement and other treatments to enhance pool habitat, reduce stream width, reconnect channels and floodplains, repair headcuts and reduce sediment input, and stabilize streambanks would all greatly improve habitat quality. Overall, the effects of these watershed treatments are beneficial to the trout. Short-term impacts could include an increase in sedimentation and turbidity due to mechanical equipment working in or near the stream during habitat and channel restoration projects. These impacts associated are expected to be of short duration and very localized. Fish will be able move out of the area and seek refuge in other areas of the stream.

Prescribed fire and mechanical treatments, would create a more resilient landscape and would reduce impacts on trout habitat by reducing the potential for a high-severity, stand-replacing wildfire. In addition, the proposed action is consistent with strategies to reduce the predicted effects of climate change on cutthroat trout by creating more resilient landscapes and addressing the issues of water quality and water quantity (Zeigler et al. 2013; Wenger et al. 2011). Reducing the forest canopy cover would decrease sublimation of snow and increase infiltration of snowmelt, which would ensure a prolonged snowmelt runoff. This may increase the base flow of streams (Baker and Ffolliott 2003).

Overall, the effects of mechanical treatments and prescribed fire are beneficial; however, short-term impacts could include runoff and sedimentation from temporary road construction, skid trails, and landings. These impacts are expected to be of short duration and very localized. Fish would be able move out of the area and seek refuge in other areas of the stream. Some ash runoff from prescribed fire may find its way into a perennial stream during monsoon storm events. Fish mortality could occur because ash and debris flows can be lethal to fish (Rinne 1996, Brown et al. 2001, USFS 2006, Patten et al. 2007).

ESA Cumulative Effects

Cumulative effects under the Endangered Species Act joint regulations are those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation. The ongoing activities in subdivisions, roads, mining, and recreation, may increase disturbance and influence water quality and quantity of spawning habitat on State and private land.

Alternative 3

This applies to the following species: Mexican spotted owl, Western yellow-billed cuckoo, Jemez Mountains salamander, Canada lynx, New Mexico meadow jumping mouse, wolverine, and Rio Grande cutthroat trout.

About 1,900 fewer acres would be mechanically treated than under alternative 1. The effects on treated stands would be the same as under alternative 1. In the remainder of the area, the effects from prescribed fire would be similar to alternative 1. Affects from all other actions are anticipated to be the same as identified under Alternative 1.

Alternative 4

This applies to the following species: Mexican spotted owl, Western yellow-billed cuckoo, Jemez Mountains salamander, Canada lynx, New Mexico meadow jumping mouse, wolverine, and Rio Grande cutthroat trout.

The forest structure would be as described in the proposed action (alternative 1), with groups and spaces and all sizes of trees. The slash treatment would be different and have different effects. The large wood could be hauled out as product and firewood. The remaining wood, less than 4-inches diameter, would remain on site. If not disposed of, it would be a fire hazard. If it is not burned, it would have to be chipped, masticated, or shredded.

While research results are not consistent, overall it appears that mastication can reduce fire hazard by putting all the woody material on the ground, reducing ladder fuels. However, if there is a great quantity of material (branches, twigs, needles), and we expect there would be, it can create a deep fuel bed. If the chips burn when the soil is dry, they will hold heat for a long time, heating and sterilizing the soil, and killing some of the remaining trees by overheating their roots. The mulch that is created will protect the soil and decompose over time, which is good for the soil. However, while it is breaking down, it will tie up soil nutrients, such as nitrogen, which won’t be available for plant and tree use. In addition, a deep bed of chips can suppress grass growth. Understory vegetation would be sparse, seedbeds for new trees would not be created, mistletoe would not be held in check, and various sizes of down wood would not be present. The stands would not be as fire-resistant as in the proposed action. For more information on the effects of slash treatment and mastication, see the fuels specialist report. The benefits of prescribed fire would be realized outside the area of mechanical treatments.

There would be fewer acres of aspen regeneration. Aspen stands in the burn areas would be stimulated and maintained. However, aspen would have a hard time sprouting in the treated areas because of the thick chips.

Old growth could be enhanced by light thinning in appropriate stands. However, stands would remain susceptible to uncharacteristically severe wildfires, because they would be outside the normal fire regime and would still have ladder fuels and low branches. Burning in untreated stands would require a narrow window of conditions and be difficult to achieve.

Alternative 5

The effects on Western yellow-billed cuckoo, Jemez Mountains salamander, Canada lynx, New Mexico meadow jumping mouse, wolverine, and Rio Grande cutthroat trout under alternative 5 are anticipated to be similar to the effects identified under alternative 1 with the exception that long-term benefits would likely be reduced where salamander habitat overlaps with MSO habitat. Short-term effects on salamander critical habitat may also be reduced due to higher residual canopy cover associated with maintaining a higher basal area in MSO habitat.

This alternative would reduce the total area treated with prescribed fire by 700 acres. This alternative would comply with the current forest plan standards and guidelines for Mexican spotted owl habitat. The proposed forest plan amendments related to treatments in Mexican spotted owl habitat would not be needed to implement this alternative. The remaining proposed forest plan amendments, those not pertaining to MSO, would be needed to implement this alternative.

All other treatments remain the same including mechanical treatments and prescribed fire in ponderosa pine and dry mixed conifer, invasive plant control, aquatic, riparian, and wildlife habitat improvement, cultural resource protection, road closure and decommissioning, construction of temporary roads, construction of gravel pits, and road maintenance. Therefore, affects from all other actions are anticipated to be the same as identified under alternative 1.

Mexican Spotted Owl

Under this alternative, the Forest would adhere to the current forest plan standards and guidelines applicable to activities in MSO habitat (USFS 1987b, Appendix D). No forest plan amendments regarding MSO would be proposed.

It may be necessary to construct handline to prevent prescribed fire from entering the core area. Natural features and roads would also be used as fire control lines, and this would minimize the amount of handline contruction needed. All activities in PACs would be conducted outside of the breeding season unless adequately conducted surveys indicate that the PAC is not occupied.

It is my determination that selection of Alternative 5 “May Affect, and is Not Likely to Adversely Affect” MSO. Beneficial effects would be short term (5-10 years).

Mexican Spotted Owl Critical Habitat

Effects on critical habitat for the owl are not likely to change the determination to “likely to adversely affect”. This is because current forest plan standards and guides direct maintaining a high canopy cover and proposed activities are not likely to result in changes to forest structure or prey habitat. Forest composition would likely remain the same and prey habitat may improve, but not to the extent expected under alternative 1. This is due to the higher basal area required to be maintained under the current forest plan (150 versus 120 under the revised recovery plan). Snags meeting the required size would be retained except where hazardous to human safety. Prescribed fire may reduce snags and woody debris, but it is not anticipated that this would cause a significant effect. Overall, implementing alternative 5 would reduce adverse effects on the Mexican spotted owl in the short term. However, the PACs and other restricted habitats would be less resilient to disturbance or other threats over time.

Sensitive Species

Affected Environment

The goal is to manage sensitive species habitat to maintain viable populations and prevent a trend toward listing under the Endangered Species Act.

The plants and animals on the regional forester's sensitive species list that occur in the area, have habitat in the area, or could otherwise be affected by proposed activities are:

- Small mammals- pale Townsend's big-eared bat
- Forest carnivores- American marten
- Riparian[34] - masked shrew, northern leopard frog, Preble's shrew, spotted bat, and water shrew
- Plants- Springer's blazing star, yellow lady's slipper, and wood lily
- Birds- American peregrine falcon, northern goshawk, gray vireo, boreal owl
- Fish- Rio Grande chub and Rio Grande sucker

Springer's blazing star, robust larkspur, and the wood lily are suspected, and likely to occur based on habitat availability to support individuals, or groups within the forest boundary. The other species are documented to exist, meaning there is a reliable, recorded observation in appropriate habitat within the forest boundary.

Forest Sensitive Species with "No Effect" determination

Sensitive species that may be affected by the proposed treatments were identified by evaluating the habitat needs of the listed species against the habitat in the project area that may be affected by proposed activities. Known occupancy or use by sensitive species was also considered.

The results were that some of the Region 3 sensitive species were excluded from further analysis because one or more of the following criteria apply: (1) the project is outside the species range, (2) the project area does not contain essential habitat, or (3) species is not known to occur in the project area. For example, the prescribed fire actions would not be expected to substantially burn or alter vegetative conditions in cool-wet habitat or in cliff or cave habitat, so those species associated with those habitats would not likely be impacted.

It was determined that for all action alternatives (1, 3, 4, and 5) the proposed treatments would have "no effect" on the following species: white tailed ptarmigan, burrowing owl, bald eagle, Lilljeborg's pea-clam, American pika, Goat Peak pika, Gunnison's prairie dog, Canada lynx, tufted sand verbena, Greene's milkweed, Chaco milkvetch, Pecos mariposa lily, Pecos fleabane, Chama blazing star, Heil's alpine whitlowgrass and Arizona willow. The reasons for excluding these species from analysis are found in the biological evaluation, which is found in the project record.

Methods Used to Analyze Effects

This analysis used the specialist reports and other information developed for the Southwest Jemez Landscape Strategy, stand exam data, aerial photo interpretation, and Forest GIS databases for

[34] Riparian habitat was evaluated as a unit, so plant and animal species are included in this grouping.

vegetation and wildlife. The vegetation and soils and water resources specialist reports prepared for this DEIS were also used to analyze effects. These databases include variables related to forest structure and forest health, i.e., wildlife habitat such as snags, downed logs, tree density, size-classes, and species, old growth, and wildlife habitat classifications. The Las Conchas fire was used to evaluate what a landscape looks like when it is departed from the historical fire regimes.

Effects on species and their habitats were evaluated at multiple scales. This project was analyzed and assessed with consideration of the best available science, forest plan standards and guidelines, research and life history literature, approved survey protocols, and professional judgment. The assumptions about the proposed restoration treatments that were used to make the determination of effect for the species and habitat are found in the biological evaluation, which is found in the project record.

Summary of Effects

General effects on the sensitive species listed previously are summarized below. A detailed analysis by species follows. The proposed treatments would have some level of adverse effects on sensitive species under all alternatives. These effects would be short term and the intensity is anticipated to be low to moderate depending on a species' specific habitat requirements. Noise, smoke, and other effects would disturb or displace animals.

The long-term benefit is improved habitat for sensitive species and expansion of those benefits across a broader landscape. Habitat would also become increasingly structurally complex and biologically diverse, with abundant herbaceous plants in scattered openings and greater dominance by large, fire-adapted trees. There would be improvements in nesting, roosting, and prey-base foraging habitat for the goshawk, and peregrine falcons would expand into more of their available habitat. Overall there would be a healthier ecological condition and a more resilient landscape to disturbance events.

The determinations of effects by alternative are as follows:

- Alternatives 1, 3, 4, and 5 may impact individuals but is not likely to result in a trend toward federal listing or loss of viability
- Alternative 2 would not result in a trend toward federal listing or loss of viability

Environmental Consequences

Effects on the Mexican spotted owl, New Mexico meadow jumping mouse, Jemez Mountains salamander, western yellow-billed cuckoo, and Rio Grande cutthroat trout are found in the previous section on threatened, endangered, and proposed species. Effects on goshawk habitat are also discussed in the vegetation section of chapter 3 and the vegetation specialist report.

Alternative 1

This alternative may affect individuals but is not likely to result in a trend toward federal listing or loss of viability for the sensitive species in the project area. Project activities may impact individuals by disturbing them during the breeding and nesting seasons, changing existing habitat characteristics, or by temporarily displacing them from their habitat. Project activities would impact species in the short term, but would be beneficial in the long term. In the case of plants and slow moving wildlife species, there may be some direct mortality as a result of restoration activities.

It is difficult to quantify the number of individual animals that might be affected by project activities because a particular species may be difficult to survey and detect. Additionally, the status of a species could change over time as they move within their habitat and through the loss or creation of habitat.

None of the sensitive species are confined solely to the project area. Thus, the restoration actions would have limited effects on overall habitat relative to the availability of habitat for these sensitive species on the district and the forest. The degree of the change in habitat components could be larger in some areas because treatment effects may build on each other. For example, mechanical treatments would be followed by a low to moderate-intensity prescribed fire. Compared to using prescribed fire only, mechanical treatments and prescribed fire would likely remove more trees more quickly than prescribed fire alone. Using only prescribed fire would not damage or kill most of the dominant and co-dominant (larger) trees, large down logs, and overstory canopy cover but would consume most of the smaller trees and fine surface fuels.

Mechanical Treatments

The restoration of fire-adapted ponderosa pine and Douglas-fir forests would make the area more resilient to disturbances such as stand-replacing wildfire. Low-intensity surface fires would be sustainable. Removing the tree canopy coverage would allow more sunlight to reach the ground and increase growth of understory plants. This should result in improved forest conditions and improve forage, nesting, and cover habitat for sensitive species. Prey availability for raptors and carnivores, such as northern goshawk and marten, should also improve.

Mechanical treatments would reduce canopy cover and likely change small mammal distribution and abundance in the short term. Increased noise from chainsaws and other equipment during the breeding season would disturb or flush birds from roosting and nesting sites. Adult birds may not nest and may abandon their nests if they are disturbed by noise or other activities. Mechanical treatments are more likely to prevent or disturb nesting in any given area. There would be little or no disturbance to nesting birds during the winter months. Additionally, removal or selective placement of large down logs at archeological sites could cause displacement of small mammals and amphibians. Machinery and vehicles may cause direct mortality by crushing individual animals or plants or by compacting surface rocks and soil and destroying habitat. Plants and small mammals and amphibians and other animals that have underground habitat would be the most affected.

Prescribed Fire

Conducting prescribed fires during the breeding season may create short-term adverse effects on sensitive species, but timing of this treatment will likely be in the fall because of more favorable burning conditions. This is also outside of most breeding seasons. Adult animals may abandon their young and leave the area if they are disturbed by noise, smoke, or other activities. In other cases, birds or mammals may not successfully raise their young. Trees may be cut to improve fireline safety before a prescribed fire and this may cause mortality of some individuals. The likelihood of this occurring is very small.

Prescribed fire would create scattered openings that would fill in with understory plants- grasses, forbs, and other herbaceous plants. Burning would likely be uneven across the area creating a mosaic of vegetation types that mimic historical conditions. The patchiness of burn patterns in interspaces and opening created by mechanical treatments would stimulate aspen growth. Little or no burning would occur on the cooler, north-facing slopes that have wet mixed conifer forests. The burning would modestly improve the structural complexity and habitat diversity that typically happens with these types of surface fires (Pilliod et al. 2006). Prescribed fire would also reduce the high amount of seedlings, saplings, young trees and fine fuels. As stand structure changes and the canopy becomes more open, prey habitat availability would improve for raptor and carnivore species (Bagne and Finch 2009).

Prescribed fire combined with mechanical treatments would preserve forest habitat for species by reducing the likelihood of an uncharacteristically severe wildfire that would damage or destroy the forest.

Other Treatments

Riparian areas, seeps, springs and wetlands are generally suitable habitat for a number of species because of the diversity of vegetation and availability of water. Logs and stumps at the edge of riparian areas may also provide suitable microhabitats for those species that transition between riparian and upland forests like the long tailed weasel or the shrew(s). Meadow, riparian, and stream channel restoration activities would likely increase forage availability for rodents, restore wetlands, and wetland obligate species, and improve aquatic conditions for fish and macro invertebrates. Species that depend on riparian areas may not use or be able to occupy areas that have nonnative and invasive plants. Controlling or eliminating these plants will conserve riparian habitat and improve habitat quality for sensitive species.

Heavy equipment may disturb the ground and compact soils when it is used in or next to meadows and riparian areas and cause direct mortality of individual small mammals, amphibians, and plants. Headcut treatments and instream aquatic habitat work could increase sediment flow into streams that may affect fish and the macro invertebrates they feed off of while the work is being done. These adverse effects are expected to be short term.

Treatments that enhance riparian habitat, seeps and springs, and instream aquatic habitat would greatly improve habitat in all perennial streams, especially San Antonio Creek and Rio Cebolla where many treatments would occur. Currently, stream channels lack connectivity to their floodplain at many locations and this limits water retention in streamside areas. As a result, vegetation needed by riparian-dependent species is limited. The improvement of habitat quality and connectivity in riparian areas would be beneficial to many species and restore aquatic functions. When watershed treatments such as instream channel work occur in streams where Rio Grande chub and Rio Grande sucker occur, it is likely that fish would be displaced or may not survive in a site specific location. Sediment and debris flows created by project activities may impact individual fish in the stream.

Road decommissioning may result in the recovery of habitat for sensitive species. Currently, the Forest is in the process of implementing the Travel Management Decision, which designates routes available for the public to travel on. The implementation is an ongoing process that will reduce wildlife impacts from vehicle travel. Road maintenance may have minor effects through the use of heavy equipment to maintain lead out ditches that keep water from eroding away the road’s surface.

Noise, smoke, and other disturbances from project activities would likely cause raptors and other birds to temporarily avoid areas when activities are taking place. The length and intensity of the disturbance would depend on the particular activity and amount of time it takes to complete it.

The effects of noise vary by species of wildlife. For example, a study looking at the effects of traffic noise from logging trucks on nesting goshawks showed that there were no negative effects on the birds (Grubb et al. 2012).

Project activities could adversely impact habitat for sensitive species such as goshawk, peregrine falcon, Rio Grande chub, and Rio Grande sucker. When watershed treatments such as instream channel work are done in streams where Rio Grande chub and Rio Grande sucker occur, it is likely that fish would be displaced or may not survive in a specific location. Sediment and debris flows created by project activities may impact individual fish in the stream.

Alternative 2

This alternative would not result in a trend toward federal listing or loss of viability for the sensitive species described because the proposed treatments would not be implemented. Current conditions would persist, and forested areas would be vulnerable to uncharacteristically severe wildfires. Riparian areas would remain degraded and in poor functioning condition. Vegetation and fuel conditions, described in the vegetation and fuels sections of the DEIS, would continue to limit the availability of prey species for some small mammals, birds, and forest carnivores.

A severe wildfire is more likely under this alternative and would adversely impact habitat for all of the sensitive species. In severely burned areas there would be a long-term loss of large trees and tree canopy, large down logs, mature stands, nesting and roosting habitat, and other key habitat features for the goshawk, peregrine, salamander, and other sensitive species. Such fires can also cause widespread mortality of less mobile sensitive species.

Alternative 3

This alternative may affect individuals but is not likely to result in a trend toward federal listing or loss of viability. About 1,900 acres would not be mechanically treated because temporary roads would not be built to access those acres. These acres would be treated with prescribed fire only. This is not a large area compared to the total number of acres planned for mechanical treatments, and the effects would remain nearly the same as alternative 1.

Soil compaction and disturbance would not occur on sites where access with temporary roads is needed. The plant, animal, and riparian groups of species would experience less noise disturbance and fewer habitat impacts from ground disturbance and soil compaction. The intensity of the effects of prescribed fire may be higher because fuels are not mechanically treated on those acres. On the 1,900 acres that are not mechanically treated, the intensity of the activities would be less than doing both mechanical and prescribed fire treatments in the same footprint. The effects from the other treatments would be the same.

Alternative 4

This alternative may affect individuals but is not likely to result in a trend toward federal listing or loss of viability. This alternative would limit the amount of prescribed fire used as compared to alternative 1. Effects on sensitive species would vary depending on the species. Effects from mechanical treatments and heavy machinery used to treat the slash and forest floor fuels may be greater than if the slash and fuels were treated with prescribed fire.

Fewer acres would be treated with prescribed fire and both the beneficial and adverse effects of prescribed fire would not occur on those acres. The acres that are not burned may be less resilient and the diversity and abundance of understory plants would likely be lower. The short-term adverse effects on sensitive species from prescribed fire (as described for alternative 1) would not occur.

Dense even-aged stands would be treated using other methods such as wood chippers or masticators in areas planned for harvest. The wood chips may interrupt the movement of species living underground and it may disrupt plant growth. Species such as aspen may not sprout due to the layer of chips, and there would be no bare mineral soil available for ponderosa pine seed to germinate. Effects from all other proposed treatments would be the same as alternative 1.

Alternative 5

This alternative may impact individuals but is not likely to result in a trend toward federal listing or loss of viability for any sensitive species in the project area. Effects would be the same as those described for alternative 1, except that there would be no effects on approximately 700 fewer acres of the core areas of Mexican spotted owl PACs. Trees greater than 9-inches diameter would not be cut in Mexican spotted owl protected activity centers. As a result, PACs could be more vulnerable to the effects of wildfire as more fuel would accumulate over time. These areas would also provide undisturbed areas for sensitive species that use forested areas outside of adjacent disturbed areas until the activities are completed.

Forest Plan Amendments

Amendments eliminating activity restrictions during wildlife breeding seasons and clarifying the language regarding interspaces would allow us to meet the desired future condition in goshawk habitat.

Amendments regarding site plans for peregrine falcons would provide more flexibility and would allow for the timely implementation of restoration treatments.

Cumulative Effects

Reasonably foreseeable forest activities that may contribute to the cumulative effects from this restoration project are listed in appendix B. The Valles Caldera National Preserve will also be undertaking restoration. Because of the shared boundary between the forest and the Preserve, actions may overlap in time and space and add to the effects on sensitive species and their habitats. Bandelier National Monument may also carry out restoration activities within the same timeframe as our project and those actions may also cumulatively add to project affects.

Foreseeable future forest restoration activities in the Southwest Jemez Mountains should alter the current trend of increasingly large and severe wildfires. The primary cumulative effect would be the reduced probability of a large, severe crown fire and the return of periodic low to moderate-intensity surface fires that improve habitat for species that evolved in these fire-adapted forests.

Several foreseeable future actions should improve habitat conditions, including implementation of forest and riparian restoration treatments in the surrounding area, and treatment of invasive plant species (USFS and VCNP 2010). These treatments would magnify the improvement to sensitive species habitat and expand those across the broader landscape. Habitat would become structurally complex and biologically diverse. Improvements in nesting, roosting, and prey-base foraging habitat for the goshawk and peregrine falcon would be found across their habitat.

Implementation of the travel management decision and road decommissioning would result in less off-highway vehicle use and reduce vehicle interaction with sensitive species. None of these are expected to cause a significant adverse impact. Foreseeable future pumice mining would slightly add to habitat disturbance. Population growth in nearby communities, firewood gathering, and recreational activities would create short-term disturbance impacts on habitat and add to disturbance effects from the proposed activities when they overlap in time and location.

We don't anticipate any other habitat altering or major disturbance activities occurring in goshawk habitat at the same time as the proposed project. No significant adverse cumulative effects on sensitive species or their habitat is expected.

Effects on Individual Species

Summary of Effects

Tables showing the amount and type of treatment under each alternative are in the biological evaluation prepared for this DEIS. These tables were used in the effects analysis and determination of effects. Descriptions of the species and their habitats are also found in the biological evaluation. Effects determinations were made for each of the sensitive species. The proposed action has the greatest level of effects on species across the landscape. Alternatives 1, 3, 4, and 5 may impact individuals but are not likely to result in a trend toward federal listing or loss of viability for the Santa Fe National Forest sensitive species evaluated below.

Rio Grande Chub and Rio Grande Sucker

In the project area, Rio Grande chubs are found in the Rio Cebolla, Rio Guadalupe, East Fork Jemez River, and in the main stem Jemez River. Rio Grande suckers are found in the Rio Cebolla, Rio Guadalupe, San Antonio Creek, East Fork Jemez River, and in the main stem Jemez River.

Projects occurring within streams, including the installation, replacement, or removal of stream crossing structures, and instream habitat improvements, would result in the direct mortality of Rio Grande chubs and suckers or the destruction or elimination of their habitat. Other effects would result in changes to fish habitat as a result of changes in the aquatic environment over time. These changes include alteration of stream channel sediment or woody debris delivery rates and amounts; modification of stream temperature regimes by reducing riparian shading, or changes in stream bank stability due to near-bank activities.

There may be some short-term, localized impacts on these fish or their habitat under the alternative 1. The proposed treatments, however, are designed to improve landscape conditions, which would benefit Rio Grande chubs in the long term. Instream habitat restoration would improve channel geomorphology and riparian treatments would increase stream shading and stream bank stability. These result in cooler water temperatures, deeper pools, and improved water quality. Upland treatments (mechanical treatments and prescribed fire), which reduce the risk of severe wildfire, would protect these stream systems from post-fire ash and debris flows, which destabilize streams and impact fish populations.

Selection of alternative 1 may impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability for Rio Grande chub and Rio Grande sucker.

Northern Leopard Frog

The northern leopard frog has been documented on the Jemez Ranger District, and there are about 3,900 acres of habitat in the project area.

The set of riparian vegetation species needed to support leopard frog habitat is currently limited or absent. Treatments that enhance wetlands (riparian areas, seeps, and springs) such as exclosures, rechannelization, and stream bank stabilization, would likely move riparian areas toward functional state and improve habitat for the frog.

Machinery and equipment may cause direct mortality of frogs as well as compaction of soil in riparian habitat. Using hand crews to reduce ladder fuels in areas that are not accessible to machinery would likely reduce the chance of direct impacts on individuals. Removal or reduction of tree canopy cover would allow more sunlight to reach the ground enhancing riparian vegetation response. After mechanical treatments, some areas of habitat may experience periods of increased warmth and dryness, which would influence plant distribution.

The selection of any of the action alternatives may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for northern leopard frog.

Northern Goshawk

There are nine known post-fledging family areas within the assessment boundary, and one partially within the area. Approximately 5,400 acres of post-fledging family area habitat and 40,463 acres of forage habitat occur within the assessment boundary. The post-fledging habitat would be managed towards 40 percent large tree structure for old growth.

Project related activities may impact species through disturbance during the breeding season in the short term, but would benefit the species in the long term. It is difficult to quantify the number of individual goshawks that would be disturbed by project activities because individuals that are not paired for breeding are difficult to find. Northern goshawks are sensitive to noise disturbance near nest sites during breeding season, but a study on the effects of logging truck noise on nesting goshawks, done in northern Arizona, found no negative effects on these birds (Grubb et al. 2012).

Mechanical treatments would improve habitat by increasing herbaceous plant growth and providing the clumpy forest structure that provides nesting and foraging habitat. Prescribed fire would decrease in plant cover in the short term while promoting a mosaic of small patches of forests and openings and increase plant species diversity. These conditions would improve habitat conditions for some of the small mammals and bird species that make up the prey base for the goshawk.

Short-term adverse effects to northern goshawk may occur from prescribed fire, including noise from human activity, a short-term decrease in plant cover, and a reduction in forage plants or seeds for prey species. Goshawks have been observed hunting along the edge of a burn for small birds or mammals moving away from the smoke. Plant species richness and community structure would likely increase after mechanical treatments and prescribed fire. Some short-term loss of foraging habitat could occur based on the shift of plant species distribution. Prescribed fire would create snags and increase snag retention; however, it may not create potential nest trees due to existing stand age and structure.

Based on the recent fires, northern goshawk habitat under alternative 2 is likely not sustainable over the long term, except where existing treatments have been conducted or are planned to minimize uncharacteristically severe wildfire.

Alternative 3 would likely result in fewer short-term effects because less area would be treated mechanically, resulting in less disturbance. Alternative 3 would not allow any temporary roads, and fewer acres would be mechanically treated. Effects are similar to alternative 1.

Alternative 4 would likely provide fewer long-term benefits because there less prescribed fire is used. This may have negative impacts on the prey base. Mechanical treatment of the slash to reduce the fuel hazards would increase the intensity and duration of disturbance compared to alternatives 1 and 5. The effects resulting from chipping or masticating slash may reduce forage availability for prey species. The intensity and duration of the activities would be less than using both mechanical treatments and prescribed fire in the same footprint under alternative 4 as compared to alternatives 1 and 5.

The selection of any of the action alternatives may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for northern goshawk.

American Peregrine Falcon

There are ten designated suitable breeding habitat zones completely within the project area and two that are partially within the project area. There are 174 falcon sites in the state of New Mexico; about 6 percent of the total sites in the State would be affected by project activities.

The effects of project activities are consistent with those described in the effects section at the beginning of the sensitive species section. A proposed site-specific forest plan amendment would permit restoration activities during the breeding season near falcon eyries. The proposed amendment would not change management direction on the rest of the forest.

Prescribed fire would be used to treat fuels and reduce risk of severe wildfire throughout the project area, including falcon habitat. Suitable nesting habitat is usually located in steep and rocky terrain without much fuel. Reducing fuel loads by use of prescribed fire would likely minimize disturbance from wildfire suppression activities in falcon habitat and minimize mortality and loss of habitat during wildfires.

Road maintenance is not likely to cause disturbance of more than a day. The construction of temporary roads and road reconstruction may cause disturbance of a few days to a week or more. This can be minimized by scheduling road construction and reconstruction activities after May 15.

Effects from mechanical treatments may result in changes to foraging habitat due to vegetation removal, disturbance to prey, or displacement or avoidance from mechanical treatments and increased human interactions. Noise impacts on wildlife would likely result in changes in habitat use, increased stress response, decreased immune response, and reduced reproductive success (Blumstein et al. 2003, Brumm 2004, Delaney et al. 1999, Gaines et al. 2003). Under certain circumstances, however, some species may become habituated to human disturbance and noise, especially where hunting pressure is reduced (Singer and Doherty 1985).

The proposed action would enhance habitat for prey for the peregrine falcon in the long term and may disturb individuals in the short term. Selecting any of the action alternatives may disturb individuals in the short term, but would provide for long term sustainability of falcon and its prey habitat as the landscape becomes more fire resilient. Selection of alternative 1 may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the American peregrine falcon.

Boreal Owl

The boreal owl is resident in very small numbers in spruce-fir habitat in the Jemez Mountains. Since 1996, no boreal owls have been observed south of the Valles Caldera. There are about 600 acres of boreal owl habitat in the project area, and approximately 193,600 acres of potential habitat on the forest. Due to a low number of observations, it is uncertain how much potential habitat is currently occupied.

Few project activities would take place in boreal owl habitat, which is found in high elevation spruce-fir and wet mixed conifer forests. These areas are not proposed for mechanical treatments. Prescribed fire is not excluded from these forest types, but these are not fire-adapted forests, and prescribed fire is not likely to be used.

Project related activities including mechanical treatments, prescribed fire, road treatments, and cultural site protection may impact this species through disturbance during the breeding season in the short term, and benefit the species in the long term.

Alternative 2 has the least amount of effects on the species and its habitat because there are fewer treatments than under any of the action alternatives. Under alternative 3, fewer acres would be treated with prescribed fire and, and fewer acres would not receive the benefits of fire.

Selection of the proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability.

Gray Vireo

There are approximately 178,400 acres of potential habitat for gray vireo on the forest and nearly 24,000 acres of that are in the project area. Due to low numbers of observations of these birds, it is uncertain how much potential habitat is currently occupied.

Short-term adverse effects on the gray vireo would occur from treatments using mechanical equipment and prescribed fire, temporary road construction, and treatments using hand crews, water development, and cultural site protection. Prescribed fire treatments would reduce plant cover in the short term, but would likely improve habitat quality in the long term by improving fire resilience and vegetative diversity.

Selection of the proposed action may impact individuals, but is not likely to result in a trend toward Federal listing or loss of viability for gray vireo.

Cinereus (masked) Shrew

There are about 262,000 acres of potential habitat for Cinereus shrew on the Forest. A total of about 2,700 acres of modeled habitat are located in the project area.

The desirable set of riparian vegetation (plant and forb) species vigorous enough to support habitat for this species in areas planned for treatment is currently limited or absent. Treatments designed to enhance riparian areas, seeps, and springs and the instream work would move shrew habitat towards restoration by connecting the stream channel to the floodplain and improving riparian vegetation. Down-cut stream channels in the project area are no longer connected to the floodplain, which limits water retention and wetland formation that supports riparian vegetation along stream banks. In their current condition, streams cannot support habitat for riparian dependent species such as shrews.

Machinery and equipment activities may cause direct mortality (death) of individuals in riparian habitat. This impact is expected to be minimal because of the localized nature of the aquatic riparian restoration activities. The use of hand crews to reduce ladder fuels or remove encroaching conifers would reduce the chance of direct impact on individuals as compared to machinery.

Removal or reduction of tree canopy coverage would allow more sunlight to reach the ground. After mechanical treatments, some areas of habitat may experience periods of increased warmth and dryness, which would influence plant micro-habitat distribution.

No mitigation measures were specifically identified for this shrew, but the measures developed to protect watersheds and riparian areas (e.g. 100-foot riparian buffer) may benefit the shrew.

Selection of the proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the cinereus shrew.

Water Shrew

The water shrew has been documented on all ranger districts on the forest. They are widespread, but not common, in the Jemez Mountains. Known capture sites on the Jemez District include the Fenton Lake area, Rio Cebolla, and San Antonio Creek. There are about 60, 200 acres of potential habitat for water shrew on the forest and nearly 3,900 acres in the project area.

The water shrew is reliant on riparian areas. This habitat type would be the most limited on the forest for these species. Treatments designed to enhance riparian areas, seeps, and springs would move riparian areas towards a desired functional state for riparian associated species in and near stream systems.

Machinery and equipment activities may cause direct mortality of the shrews by crushing and compaction of soil in riparian areas. The use of hand crews to reduce ladder fuels or remove encroaching conifers would reduce the chance of direct impact on individuals as compared to machinery. Removal or reduction of tree canopy coverage would allow more sunlight to reach the ground.

The desirable set of riparian vegetation (plant and forb) species vigorous enough to support habitat for this species in areas planned for treatment is currently limited or absent. Treatments designed to enhance riparian areas, seeps, and springs and the instream work would move shrew habitat towards restoration by connecting the stream channel to the floodplain and improving riparian vegetation. Down-cut stream channels in the project area are no longer connected to the floodplain, which limits water retention and wetland formation that supports riparian vegetation along stream banks. In their current condition, streams cannot support habitat for riparian dependent species such as shrews.

Instream and rechannelization work would improve aquatic and riparian habitat. However, work may impact species present in the areas through direct mortality of machinery compacting soils. Potential flooding may displace individuals in the immediate site and adjacent to the construction site. The greatest amount of sediment inputs would come from a tractor being used in or near the stream or crossing the stream.

Prescribed fire would result in a decrease in plant cover in the short term. Prescribed fire would also create patches of small openings that would enhance plant species diversity. Plant species community richness or diversity would increase following burning creating small canopy gaps. Short-term adverse effects on plant communities would also occur as a result of burning. Some level of short-term loss could occur based on the shift of plant species distribution. These short-term effects should be small in extent and intensity on individual shrews foraging during project implementation. Foraging opportunities may be limited in the home range of individuals shortly after implementation starts.

Road closure and decommissioning may result in the recovery of plant habitat. Road maintenance activities would have no significant effect because it occurs in the existing roadway footprint. Road maintenance would likely reduce sediment runoff in conjunction with watershed best management practices outlined in appendix A. Control of invasive plants would promote a healthier habitat for native plant communities.

Selection of the proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the water shrew.

Preble's Shrew

The amount and type of habitat for Preble's shrew is the same as that for the water shrew. Preble's shrew has been documented on the Cuba and Jemez Ranger Districts and is suspected to occur on the Espanola, Coyote, and Pecos/Las Vegas Ranger Districts.

Machinery and equipment activities may cause direct mortality of the shrews by crushing and compaction of soil in riparian areas. The use of hand crews to reduce ladder fuels or remove encroaching conifers would reduce the chance of direct impact on individuals as compared to machinery. Removal or reduction of tree canopy coverage would allow more sunlight to reach the ground. After mechanical treatments, some areas of habitat may experience increased warmth and dryness, which would influence plant micro-habitat distribution.

The desirable set of riparian vegetation (plant and forb) species vigorous enough to support habitat for this species in areas planned for treatment is currently limited or absent. Treatments designed to enhance riparian areas, seeps, and springs and the instream work would move shrew habitat towards restoration by connecting the stream channel to the floodplain and improving riparian vegetation. Down-cut stream channels in the project area are no longer connected to the floodplain, which limits water retention and wetland formation that supports riparian vegetation along stream banks. In their current condition, streams cannot support habitat for riparian dependent species such as shrews.

Prescribed fire would result in a decrease in plant cover in the short term. Prescribed fire would also create patches of small openings that would enhance plant species diversity. Plant species community richness or diversity would increase following burning creating small canopy gaps. Short-term adverse effects on plant communities would also occur as a result of prescribed fire. Some level of short-term loss could occur based on the shift of plant species distribution. These short-term effects should be small in extent and intensity on individual shrews foraging during project implementation. Foraging opportunities may be limited in the home range of individuals shortly after implementation starts.

Road closure and decommissioning may result in the recovery of plant habitat. Road maintenance activities would have no significant effect because it occurs in the existing roadway footprint. Road maintenance would likely reduce sediment runoff in conjunction with watershed best management practices. Control of invasive plants would promote a healthier habitat for native plant communities. Preparation of fire control lines is not likely to take place during the monsoon period with the potential exception of hand thinning.

Selection of the proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for Preble's shrew.

Spotted Bat

Due to the rarity of the spotted bat, information is lacking about its habitat needs and life history. Approximately 77,000 acres of spotted bat habitat were modeled for this analysis. It is uncertain how much potential habitat is currently occupied.

The desirable set of riparian vegetation (plant and forb) species vigorous enough to support habitat for this species in areas planned for treatment is currently limited or absent. Treatments designed to enhance riparian areas, seeps, and springs and the instream work would move shrew habitat towards restoration by connecting the stream channel to the floodplain and improving riparian vegetation. Down-cut stream channels in the project area are no longer connected to the floodplain, which limits water retention and wetland formation that supports riparian vegetation along stream banks. In their current condition, streams cannot support habitat for riparian dependent species such as this bat.

Prescribed fire would result in a short-term decrease in plant cover. Prescribed fire would also create patches of small openings that would enhance plant species diversity. Plant species community richness or diversity would increase following burning creating small canopy gaps. Some level of short-term loss could occur based on the shift of plant species distribution. These short-term effects should be small in extent and intensity.

Road closure and decommissioning may result in the recovery of plant habitat. Road maintenance activities would have no significant effect because it occurs in the existing roadway footprint, and existing roads are not suitable plant habitat. Road maintenance would likely reduce sediment runoff in conjunction with watershed best management practices. Control of invasive plants would promote a healthier habitat for native plant communities. Preparation of fire control lines is not likely to take place during the monsoon period with the potential exception of hand thinning.

Plant diversity affects the abundance and richness of insect populations. Short-term effects resulting from prescribed fire could create a shift of the prey species available for foraging and in canopy gaps created by mechanical treatments. Once these communities respond and adjust to the treatments, a change or shift of the plant diversity would then enhance forage opportunities for spotted bat.

Selection of the proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the spotted bat.

Pale Townsend's Big-eared Bat

There are about 302,600 acres of potential habitat for the Pale Townsend's big-eared bat on the forest. It is uncertain how much potential habitat is currently occupied. The status of this species could change over time as it moves between forage habitat and roosting habitat or through loss or creation of habitat.

Short-term adverse effects on bat would occur as a result of mechanical treatments prescribed fire, road treatments, water source development, treatments using hand crews, and cultural site protection. Use of prescribed fire would result in a short-term decrease in plant cover. Plant species community richness or diversity would increase from the creation of small canopy gaps and patches. The patchiness of the forest would improve habitat for the prey base.

Prescribed fire treatments could cause a loss of large logs resulting in short-term adverse effects on foraging habitat due to localized impacts on insect prey species distribution. A short-term loss of plant diversity could also cause a shift in plant species distribution. Prescribed fire and hazard tree removal actions (fire control line preparation) would reduce large snag distribution. The loss of large logs would reduce the amount of insects available for foraging. The shift in snag distribution would also reduce roosting habitat in the forest. Forested habitat near cave openings could be changed by project activities.

Selection of the proposed action may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for Pale Townsend's big-eared bat.

American Marten

There are about 263,900 acres of potential habitat for the American marten on the Forest. About 2,800 acres of modeled habitat are in the project area. Marten have not been documented in the project area, but they are suspected to exist on the Jemez Ranger District. Due to no documented observations, it is uncertain how much potential habitat is currently occupied.

Mechanical treatments would increase herbaceous plant growth in the long term by removing the thick layer of dead plant debris on the forest floor. Prescribed fire would result in a decrease in plant cover in the short term, but would also improve habitat for the marten's prey base by creating gaps and openings in the tree canopy and increasing plant species diversity. Short-term adverse effects on marten would occur as a result of burning. Prescribed fire would likely reduce the high volume of fallen trees and woody debris on the forest floor. This loss of large logs could result in short-term adverse effects on forage, cover, and breeding activities due to localized impacts on tree species distribution.

Prescribed fire and hazard tree removal actions would also reduce large snag distribution in the project area. This may reduce or shift prey species abundance and distribution. Large snags are limited or rare across the project area, and snags created by prescribed fire may not be large enough to support the recruitment of down logs for marten. Individual martens can dig underneath logs for food or underneath highly logs for den sites. Typically, these down logs are important for thermal cover or protection from the weather during winter months. Prescribed fire may create more snags to provide forage habitat for marten. The recruitment of snags may also provide for den site opportunities in the long term.

Tree shade canopy would be reduced following hazard tree removal, mechanical treatments, and prescribed fire. Canopy cover in marten habitat is not expected to be reduced below 40 percent in groups and clumps across the project area. Reduction in canopy cover may shift or increase prey species distribution in these open areas or in areas where canopy cover is reduced.

Some loss of trees of all types and diameter size classes would occur from actions such as prescribed fire, and mechanical treatments. The area is expected to maintain a range of tree sizes and species needed to maintain habitat across the landscape. Removal of tree size classes may occur as part of temporary road construction and road maintenance. The effects created by changed in tree size class should be small in extent and intensity, occurring near disturbed sites, access roads, and other areas that are not typically occupied by martens or that provide opportunities for den sites.

The effect of the project activities on forest carnivores for each alternative is documented in the project record. Alternative two had fewest effects on modeled habitat because there are fewer projects. The effects of the activities on modeled habitat did not show any significant difference between alternatives one and two.

Selection of any of the action alternatives may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the American marten.

Yellow Lady's Slipper

There are about 30,600 acres of habitat modeled on the Forest and zero acres of habitat in the project area. There are no known populations in the Jemez Mountains.

The desirable set of riparian vegetation species vigorous enough to support habitat for this species in areas planned for treatment is currently limited or absent. Treatments designed to enhance riparian areas, seeps, and springs and the instream work would move habitat towards restoration by connecting the stream channel to the floodplain and improving riparian vegetation. Down-cut stream channels in the project area are no longer connected to the floodplain, which limits water retention and wetland formation that supports riparian vegetation along stream banks. In their current condition, streams cannot support habitat for riparian dependent species. Treatment strategies to enhance riparian areas, seeps and springs, and instream work would move habitat for this plant towards restoration. Using exclosures would also help support habitat for this species.

Prescribed fire would result in direct mortality of the yellow lady's slipper. This is a short-term effect. Plant species community richness or diversity would increase from the creation of small canopy gaps and patches of trees. If colonies of this plant exist in aspen stands, short-term adverse effects on this species would also occur as a result of prescribed fire. Plant species may increase in the environment it grows in following prescribed fire.

Machinery and equipment activities may cause direct mortality of lady's slipper plants by crushing and compaction of soil in riparian areas. Removal or reduction of tree canopy coverage would allow more sunlight to reach the ground. After mechanical treatments, some areas of habitat may experience increased warmth and dryness, which would influence plant micro-habitat distribution. The response of this plant to project activities could shift or stunt the flowering of plants if prescribed fire treatments occurred prior to flowering or during the peak of the growing season.

Road closure and decommissioning may result in recovery of plant habitat. Road maintenance activities would have no significant effect because it occurs in the existing roadway. Road maintenance would likely reduce sediment runoff in conjunction with watershed best management practices outlined in appendix A. Construction of temporary roads may compact the soil and reduce rooting of plants. Control of invasive plants would promote a healthier habitat for plant communities.

Selection of any of the alternatives may affect individuals, but is not likely to result in a trend toward federal listing or loss of viability for the yellow lady's slipper.

Wood Lily

There are about 52,200 acres of modeled habitat on the forest and nearly 3,600 acres of habitat in the project area. The wood lily has been reported on the Jemez Ranger District, but there have been no observations in the project area.

Mechanical or prescribed fire treatments would increase herbaceous plant growth in the long term by removing the thick layer of dead plant debris on the forest floor. Prescribed fire would result in short-term adverse effects on plant communities, including a decrease in plant cover. The richness and diversity of plant species would increase after burning from the creation of small canopy gaps and patches of trees. Short-term loss of the wood lily could occur based on the shift of the distribution of plant species.

Machinery and equipment activities may cause direct mortality of the plants by crushing and compaction of soil in riparian areas. Removal or reduction of tree canopy coverage would allow more sunlight to reach the ground. After mechanical treatments, some areas of habitat may experience increased warmth and dryness, which would influence plant micro-habitat distribution.

Road closure and decommissioning may result in recovery of plant habitat. Road maintenance activities would have no significant effect because it occurs in the existing roadway, and roads are not suitable plant habitat. Road maintenance would likely reduce sediment runoff in conjunction with watershed best management practices Control of invasive plants would promote a healthier habitat for plant communities.

The short-term effects from mechanical treatments should be small in extent and intensity and would affect the wood lily only during the flowering season of June and July each year. A seed source may be available prior to prescribed fire treatments outside the peak flowering months. If burning occurs during June and July, it may disrupt the next flowering season and affect the ability of the plants to provide an annual seed source.

Selection of any of the alternatives may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for the wood lily.

Springer's Blazing Star

Nearly 14,000 acres of potential habitat are found on the Forest; about 6,383 acres of modeled habitat are in the project area. The Springer's blazing star has not been documented on the Forest but is suspected to be on the Jemez and Espanola Ranger Districts. Due to a low number of observations, it is uncertain how much potential habitat is currently occupied.

Over the long term, treatments would promote conditions suitable for increasing herbaceous plant growth by removing the thick layer of dead plant debris on the forest floor. Prescribed fire would result in short-term adverse effects on plant communities, including a decrease in plant cover. The richness and diversity of plant species would increase after burning from the creation of small canopy gaps and patches of trees. Short-term loss of the blazing star could occur due to mechanical treatments. These should be short term and small in extent and intensity because of the type of substrate where the plant is found.

Road closure and decommissioning may result in recovery of plant habitat. Road maintenance activities would have no significant effect because it occurs in the existing roadway, and roads are not suitable plant habitat. Road maintenance would likely reduce sediment runoff in conjunction with watershed best management practices. Control of invasive plants would promote a healthier habitat for plant communities.

The effect of the project activities on sensitive plant species for each alternative is documented in the project record. Alternative 2 had the least amount of effects because there are fewer projects.

Selection of any of the alternatives may affect individuals, but is not likely to result in a trend toward Federal listing or loss of viability for Springer's blazing star.

Management Indicator Species

Affected Environment

The forest has eight management indicator species (MIS): Rocky Mountain bighorn sheep, Rocky Mountain elk, Mexican spotted owl, Merriam's turkey, hairy woodpecker, Rio Grande cutthroat trout, pinyon jay, and mourning dove (USFS 1987).

Seven of the eight management indicator species occur or have habitat in or adjacent to the project area; the Rocky Mountain bighorn sheep does not. All streams contain nonnative trout species such as rainbow, brown, and brook trout. There are no known genetically pure occupied Rio Grande cutthroat trout populations in the project area.

Table 42 shows the habitat association for each MIS in the project area based on information in the EIS for the forest plan EIS (USFS 1987) and the Management Indicator Species Assessment (USFS 2012b). The table also shows the total acres of each habitat association forestwide and within the project area and population and habitat trends based on the latest MIS assessment for the forest (USFS 2012b).

Table 42. Management indicator species, habitat, and population and habitat trends. For most species, population and habitat trends are stable or increasing. Habitats for Mexican spotted owl and pinyon jay are declining.

Species	Habitat Association	Forestwide Acres or Stream Miles	Project Area Acres or Stream Miles	Population Trend	Forestwide Habitat Trend
Rocky Mountain Elk	Mid-elevation Grasslands, Meadows, and Forest	1,287,640 acres	109,686 acres	Increasing	Stable
Merriam's Turkey	Mature Ponderosa Pine Forest	603,23 acres	44,810 acres	Stable to Increasing	Stable

Species	Habitat Association	Forestwide Acres or Stream Miles	Project Area Acres or Stream Miles	Population Trend	Forestwide Habitat Trend
Mourning Dove	Mid and Low Elevation Grasslands, Woodlands, and Pine	581,419 acres	56,094 acres	Stable	Stable to Increasing
Hairy Woodpecker	Mature Forest and Woodland	80,174 acres	7,258 acres	Abundant	Increasing
Pinyon Jay	Piñon-Juniper Woodlands	232,204 acres	4,650 acres	Stable to Downward	Declining
Mexican Spotted Owl	Late Seral Stage Mixed Conifer, Coniferous Riparian	630,191 acres	31,590 acres	Stable	Slightly Declining
Rio Grande Cutthroat Trout	Riparian, Stream Habitat	128.7 stream miles	11 stream miles	Precariously Upward	Stable
Rocky Mountain Bighorn Sheep	Alpine Meadow	7,810 acres	0 acres	Stable	Stable

The declining habitat trend for pinyon jay is due to the beetle-caused piñon tree mortality in the early 2000s. The lack of water, foraging habitat, and vegetative diversity limits habitat for elk, Merriam's turkey, and mourning dove. The lack of openings in the forest canopy also limits elk habitat. Some key problems affecting the owl habitat in this area are the lack of large, mature trees and small forage openings.

Summary of Effects

There will be no reduction in the number of acres of available habitat for any of the MIS, and there is no potential for population decline under all alternatives.

Effects from project activities are similar under all action alternatives (1, 3, 4, and 5). There would be short-term disturbance effects from noise, smoke, and human activity. There would also be the long-term benefit of habitat enhancement for all MIS. Differences between the proposed action and alternatives 3, 4, and 5 are:

- Under alternative 3, there would be less soil compaction and more vegetation would be retained because temporary roads are not built. The amount and intensity of disturbance effects from project activities will be lower because fewer acres receive both mechanical treatments and prescribed fire.
- Under alternative 4, there would be fewer effects from smoke because fewer acres are treated by prescribed fire. Some temporary disturbance effects on management indicator species (MIS) may be magnified under this alternative depending on the method used to treat slash and woody debris. Long-term benefits such as nutrient recycling and snag creation would not occur.
- Under alternative 5, there would be a temporary disturbance from the construction of fire control lines near core areas. There would be less potential to enhance understory plant growth and prey habitat because PACs and target/threshold areas would have a higher

density of trees. The fire hazard would not be reduced as much as compared to alternative 1.

Under alternative 2, habitat conditions would remain the same in the short term, but would continue to decline and be less resilient to wildfire over time. This alternative would not decrease the potential of an uncharacteristically large wildfire. A wildfire could result in a reduction of habitat acres for some MIS species. Short-term effects from noise and other disturbances would be less but would continue at a lesser degree than the other action alternatives. Long-term benefits, such as habitat improvement, would not occur. The prey base for the Mexican spotted owl would not be enhanced.

Environmental Consequences

Alternative 1

There would be no reduction in the number of acres of available habitat for any MIS and no potential for population decline. Long-term benefits are expected due to increased forage and water and the decreased potential for uncharacteristic wildfire. All proposed activities would have temporary, short-term effects including noise and visual disturbance (heavy equipment use, chainsaws), human activity, and smoke from prescribed fire. Management indicator species may temporarily avoid areas where activities are being conducted.

Mechanical treatments, prescribed fire, and meadow restoration would create openings in the tree canopy, enhancing the production of understory forage plants for elk, turkey, and mourning doves over a large portion of the project area. Forage plant palatability and nutrient content would be expected to improve. With increased forage, competition with livestock for forage would decrease. There would be no reduction of the overstory canopy within Mexican spotted owl core areas.

The current abundance of thermal and hiding cover for elk and turkey would be modified. More open tree groups resulting from mechanical treatments would reduce cover until understory shrub and tree species (e.g. New Mexico locust, Gambel oak) move into the openings. Understory trees killed by prescribed fire would gradually fall over in random patterns, so hiding cover would remain quite variable across the area until all the understory trees are down.

Mechanical treatments in piñon-juniper woodlands would reduce the numbers of trees available for nesting, forage, and roosting by pinyon jay over about 1,000 acres (about 3% of available piñon-juniper in the project area). Piñon-juniper would still be available on these treated sites and on the approximately 33,500 acres of piñon-juniper woodlands that would not be treated. Reducing tree density in piñon-juniper stands would reduce competition among trees for water and increase the vigor of the remaining trees, resulting in more seed production.

Enhancement of seeps and springs, construction of new artificial water sources (earthen dams, trick-tanks) and screening of water sources would increase the availability and distribution of water. All land-based MIS would benefit from these treatments.

Road treatments, including opening existing closed roads and building new temporary roads would increase disturbance along those roads for all land-based species. Disturbance is expected to extend up to about 0.3-mile along both sides of the road during project activity periods (USDA 2011). Disturbance from recreational activities such as mountain biking and hiking may continue after project activities are completed, even if roads are closed.

Proposed activities would maintain desired habitat components such as large snags, trees, and down wood, benefiting turkey and hairy woodpecker, and increasing habitat for the prey base of the spotted owl. Mechanical treatments would reduce tree density, but large trees would still be present to provide nest sites. The number of snags for the hairy woodpecker would increase, as prescribed fire would be expected to create more snags throughout the project area.

Implementing prescribed fire treatments would reduce fuel loading which would minimize soil temperatures and the acreage of high-intensity fire in watersheds and, in turn, protect aquatic ecosystems from soil loss and run-off resulting from large wildfires. In addition, prescribed fires are not typically set within riparian areas, but are allowed to creep into the area for a low-intensity burn. These burns would increase and enhance understory herbaceous vegetation, which in the long term, would improve water quality in streams. Some activities, particularly mechanical treatments, would increase the amount of run-off and sediment into streams; this is a short-term, temporary effect. Best management practices, design features, and mitigation measures would minimize runoff from roads and skid trails.

Some treatments are designed to enhance riparian and stream channel conditions. These would increase the amount and diversity of instream habitat and overstory vegetation and would improve habitat conditions for Rio Grande cutthroat trout. Turkey would also benefit from increased nesting habitat in riparian areas. Instream restoration activities may negatively impact some individuals or their habitat in the short term, the results would be beneficial in the long term.

Alternative 2

There would be no reduction in number of acres of available habitat for any MIS and no potential for population decline. Because this alternative would not reduce the potential for uncharacteristic wildfire, future wildfires could result in a reduction of habitat acres for some MIS species. There would be no benefits of increased forage and water availability and no enhancement of riparian quality.

Habitat conditions, however, would not improve overall due to the continued lack of diversity. Large trees, snags, and down logs would continue to be lacking, affecting hairy woodpecker and other species that need these components. The abundance and quality of shrubs, seeds, nuts, acorns, fruits, berries, and tall young grasses and forbs would all continue to decline and reduce habitat quality for all MIS. There would be no treatments in owl habitat to enhance prey numbers and distribution.

This alternative would result in fewer effects on MIS habitat trends because the proposed activities would not be implemented. There would be fewer noise or visual disturbances to management indicator species. The area would be more vulnerable to, and could increase food sources (insects and fungi) for turkeys and other birds, such as insects and fungi. Insect and disease outbreaks would also result in premature tree mortality, thus creating more snags for the hairy woodpecker.

Alternative 3

There would be no reduction in the number of acres of available habitat for any MIS and no potential for population decline. Long-term benefits are expected because of increased forage and water and a decreased potential for uncharacteristic wildfire.

Soil compaction would be reduced and vegetation for MIS habitat would be maintained on the 1,900 acres that are not mechanically treated. Disturbance from project activities, such as noise and human activity, would be less than under alternative 1. The potential for increased recreational use on temporary roads would be eliminated. Prescribed fire would be used on the same footprint as alternative 1, with similar effects. The intensity of the disturbance from treatments would be less than doing both mechanical treatment and prescribed burning in the same footprint. All other project level effects on MIS habitat would be the same as under alternative 1.

Alternative 4

There would be no reduction in the number of acres of available habitat for any MIS and no potential for population decline. Long-term benefits are expected because of increased forage and water and a decreased potential for uncharacteristic wildfire.

Under this alternative, prescribed fire would not be used in areas that are mechanically treated. The short-term, adverse effects of fire (smoke, soil heating) would not be present 29,900 acres of the project area. Long-term benefits of fire such as recycling of nutrients and snag creation would not occur. All other proposed treatments and project effects would be the same as alternative 1.

Alternative 5

There would be no reduction in the number of acres of available habitat for any MIS and no potential for population decline. Long-term benefits are expected because of increased forage and water and a decreased potential for uncharacteristic wildfire.

Project level effects on MIS habitat would be the same as Alternative 1 with the following exceptions:

Within MSO protected activity centers, no trees over 9-inches diameter would be cut. There would be no treatments in the core area (about 100 acres) surrounding the known or best estimated nest site. To keep prescribed fire out of core areas, fire control lines would be built and we might need to remove more ladder fuels and down woody debris, and small trees and shrubs along the fire control lines. This would create a temporary disturbance and have a short-term impact on understory vegetation over a small area. Effects would be negligible on MIS. Target/threshold habitat for the owl would be maintained at a higher tree density. This would result in reduced openings or gaps in the tree canopy in PACs and target/threshold acres as compared to alternatives 1, 3 and 4. These less intense mechanical treatments could result in a slightly higher risk of fire hazard within the PACs as compared to the other alternatives. Because of the denser tree canopy, there would be less potential to enhance understory vegetation, and prey habitat would not improve as much as compared to the other alternatives.

Lighter mechanical treatments in PACs, core areas, and target/threshold habitat would reduce the potential for improvements in forage for elk, turkey, and mourning dove within these owl habitat types as compared to other alternatives. This reduction is negligible when compared to overall number of acres in the project area that would have improved forage conditions. Detailed information on the type and amount of acres treated in owl habitat is the biological assessment.

Forest Plan Amendments

The forest plan amendments related to vegetation treatments in PACs would result in lower tree densities with more canopy gaps, more large trees in the long term, and increased understory vegetation and prey habitat resulting in enhanced habitat for most MIS, including elk, turkey, MSO, hairy woodpecker, and mourning dove. The greatest benefit would be the reduction in risk of severe wildfire that could cause widespread loss of forested habitat across the project area, especially in areas such as Virgin Canyon. A wildfire in that area could burn through three adjoining PACs.

The effects from the forest plan amendment allowing treatments to occur during wildlife breeding seasons and in peregrine falcon zones would remove the protection that some MIS nesting birds (turkey, mourning dove, and woodpecker) would have been afforded in these areas. This could result in increased unintentional take of nesting MIS birds.

The effects of the forest plan amendment clarifying the language about interspaces would be beneficial to turkey, mourning dove, and elk by creating additional canopy opening, increasing ground vegetation, food sources (seeds and insects), and shrubs for food, cover and nesting. These treatments would be done in conjunction with other vegetation treatments, and so there would be no appreciable increase in direct disturbance effects. Long term, the treatments would result in more large trees across the landscape, which would enhance habitat for the hairy woodpecker.

The effects of the forest plan amendment regarding scenery would allow more vegetation treatments to occur in those areas. The resulting changes in vegetation in those areas would have negligible effects on MIS habitat.

Cumulative Effects

No significant cumulative impacts on population or habitat trends are expected to result from the proposed action or other alternatives in combination with other projects or activities. Potential activities include foreseeable future forest activities on forest lands (appendix B). These activities would add to the effects on MIS predicted to result from the proposed action and other action alternatives. Management indicator species population and habitat trends would not be altered by direct, indirect or cumulative effects of the proposed action.

The primary cumulative effects would be the reduced probability of a large, uncharacteristically severe wildfire and the return of periodic low- to moderate-intensity surface fires that improve habitat for species that evolved in these fire-adapted forests. Foreseeable future forest restoration activities in the Valles Caldera and adjacent areas of the Jemez Mountains would likely alter the current trend of increasingly large and severe wildfires.

Future mechanical treatments, riparian, in stream habitat, stand improvement thinning, and prescribed fire activities would magnify the improvements to sensitive species habitat expected from the proposed actions. These treatments may also expand these benefits to the broader landscape.

Temporary cumulative effects could result in areas where treatments covered by this DEIS overlap with each other or with activities such as pumice mining. Increased noise and visual disturbance could result from increased vehicle activity on roads and project activities. These temporary effects would not be expected to impact overall populations or habitat trends.

Migratory Birds

Affected Environment

Migratory birds and their habitats are protected under the federal Migratory Bird Treaty Act of 1918. This section addresses requirements in Migratory Bird Treaty Act Executive Order 13186.

Habitat conditions for migratory birds have been altered from historical conditions and are degraded, mainly due to long-term fire exclusion. Frequent surface fires once maintained healthy and diverse fire-adapted ecosystems, and migratory birds using this area evolved under frequent surface fire regimes. Many of the birds need surface plant cover underneath the conifer trees or as edge habitat in openings next to clumps of trees. The quality of migratory bird habitat in the area is limited because there are not enough grasses, forbs, and shrubs. Thinning dense pine stands, leaving snags and some older trees, and restoring historical fire regimes would improve habitat conditions significantly (NMPIF 2007).

Another limiting factor is water. Water sources are scarce in the project area; limited to streams and springs that have experienced lower flows during the drought. Some springs have stopped flowing altogether. Riparian areas have become dewatered due to stream downcutting and are experiencing encroachment from conifers, in part, due to a lack of fire and loss of wetland habitat.

Methods

This evaluation addresses general effects on migratory birds and effects on Highest Priority species for the main habitat types found in the project area (NMPIF 2013).

The Forest Service currently analyzes effects on migratory birds in the following manner:

- Effects on Highest Priority species listed by NM Avian Conservation Partners
- Effects on Important Bird Areas (IBAs)
- Effects on Important Overwintering Areas (IOAs)

The National Partners in Flight list was used for the species selected from New Mexico list of priority species. All highest priority species were reviewed for vegetation types found in the project area. The analysis also used Audubon New Mexico’s designated IBAs and IOAs for migratory birds (ANM 2013). The Valles Caldera IBA is within one mile of the project area, and it would not be affected by the proposed actions. No other IBA would be affected by project activities, and no IOAs are documented within a mile of the project area.

Summary of Effects

Unintentional take of some individual birds may occur under alternatives 1, 3, 4, and 5, but no long-term impacts on bird populations are expected. Bird communities may shift at specific sites where habitat modifications occur; for example, meadow restoration may increase populations of open grassland bird species, and riparian enhancement may increase riparian species. Restoration projects are anticipated to benefit birds in many areas by reducing the thickets of small trees, which would result in future growth of shrubs, forbs, and grasses. This in turn would increase food sources (seeds, berries, insects) and cover.

Because alternative 2 will not implement projects that could result in the reduction of risk of large wildfires, there could be long-term impacts to bird populations because of widespread loss of forest stands in the event of a large wildfire.

Environmental Consequences

Alternative 1

All proposed activities would have short-term effects on migratory birds from noise and visual disturbance, human activity, and smoke. Adult birds would avoid these disturbances while activities are taking place. There could be unintentional take of some individuals, especially ground-dwelling species or nesting birds if activities take place during the breeding season. The measures listed in appendix A would minimize impacts. Long-term benefits are expected because of the decreased potential for uncharacteristic wildfire and the associated reduction of risk of habitat loss.

Mechanical treatments, prescribed fire, and meadow restoration would create canopy openings, resulting in increased ground cover, shrubs, and increased distribution of aspen. There would be no reduction of overstory canopy in Mexican spotted owl core areas. Birds would benefit from an increase in types of food (berries, seeds, insects), nesting sites, and cover over a large portion of the project area. The prey base for owls and hawks should increase with enhancement of habitat.

Birds would also benefit from increased availability and distribution of water resulting from the enhancement of seeps and streams, construction of new artificial water sources (earthen dams and trick-tanks), and screening of water sources from human disturbance. The riparian enhancement projects would increase nesting and foraging habitat along streams and rivers for riparian species.

Vegetation treatments in piñon-juniper woodlands would reduce tree density, and there would be fewer trees available for nesting, food, and roosting on about 1,000 acres. About 33,500 acres of piñon-juniper woodlands in the project area would not be treated and would be available for bird use. Treatments of piñon-juniper stands would reduce competition among trees for water and increase the vigor of remaining trees.

There would be no impacts on cliff or cave dwelling birds other than temporary effects of smoke from prescribed burns, or some possible noise disturbance depending on distance from project activities. There would be few impacts on birds living in spruce-fir habitat because there are few, if any project activities in that cover type. Smoke from prescribed fire could have short-term, temporary effects.

Opening existing closed or building new temporary roads would increase disturbance along those roads, and could disrupt some nesting behavior. Disturbance is expected to extend up to about 0.3 mile from either side of roads during the project period (USDA 2011). After activities are completed and roads are closed, there could be increased disturbance because of recreational use or unauthorized off-road vehicle use.

Alternative 2

This alternative would have fewer effects on birds because many of the proposed treatments would not be implemented. The activities listed in appendix B would have fewer noise or visual disturbance effects on birds. Food sources, particularly insects, for woodpeckers, flycatchers and other birds would increase due to insect or disease outbreaks. Premature tree mortality resulting from dense stand conditions or insect and disease, would increase snags for cavity nesters.

Habitat conditions, however, would not improve across the area due to the continued lack of diversity. Large trees, snags and large down logs would continue to be lacking. The abundance and quality of shrubs, seeds, nuts, acorns, berries, and tall young grasses and forbs would continue to decline and habitat quality would be reduced. The potential for increases in prey numbers and distribution for raptors would also be reduced.

This alternative would not implement projects that could reduce the risk of large, severe wildfires. Stand-replacing wildfires could result in the long-term loss of habitat acres for some species or habitat conversion that influences migratory bird communities.

Alternative 3

Disturbance from project activities and equipment use would be less than under alternative 1 because fewer acres would be mechanically treated and temporary roads would not be built. The potential for increased recreation use on decommissioned temporary roads would be eliminated.

Those acres not treated mechanically would be treated only with prescribed fire. The intensity of the activities would be less than doing both mechanical treatments and prescribed fire in the same footprint. The area that is not mechanically treated (1,900 acres) is not large in comparison to the total number of acres mechanically treated under alternative 1. All other project level effects on migratory birds would remain the same as Alternative 1.

Alternative 4

Prescribed fire would not be used in areas that are mechanically treated. Chipping, mastication or other methods would be used to treat slash. The short-term adverse effects of prescribed fire (smoke, soil heating) would not occur in mechanically treated areas. Long-term benefits such as nutrient recycling and snag creation would not occur in areas not treated with fire. All other project level effects to birds would remain the same as described for alternative 1.

Alternative 5

Project level effects on migratory bird habitat would be the same as described for alternative 1, except as described below.

Within Mexican spotted owl PACs, trees over 9-inches diameter would not be cut, and no activities would occur in the core areas of PACs. There would be temporary disturbance from construction of fire control lines around core areas and the removal of ladder fuels, shrubs, and woody debris to keep fire out of core areas. This would have a temporary impact on understory vegetation over a small area with negligible effect to migratory birds. Mexican spotted owl target/threshold habitat would be maintained at a higher tree density level. This would result in fewer openings in the overstory canopy in PACs and target/threshold habitat as compared to alternatives 1, 3 and 4. The fire hazard would also be slightly higher as compared to the other action alternatives. Because of the denser canopy cover, the abundance and diversity of understory shrubs, grasses, forbs would be lower, resulting in lower quality prey habitat for hawks and owls. Lighter treatments would also reduce the potential for improvements to cover and other foods sources (seeds, insects) in PACs and target-threshold habitat. This reduction is negligible when compared to the total number of acres that would have increased understory vegetation in the project area.

Forest Plan Amendments

The effects of the proposed forest plan amendment allowing activities to occur during wildlife breeding seasons and in peregrine falcon zones would could result in increased unintentional take of migratory birds with overlapping breeding seasons or that nest in the falcon zones.

The effects of the proposed forest plan amendment clarifying the language for interspaces would be beneficial to migratory birds by creating additional canopy openings, increasing ground vegetation for seeds and insects, and shrubs for cover and nesting. Treatments would be done in conjunction with other vegetation management activities in same areas, and there would be no appreciable increase in direct disturbance effects. Over the long term, the treatments would result in more large trees across the landscape and that would enhance nesting and foraging habitat.

The effects of the forest plan amendments regarding scenery would allow some management activities to take place. The resulting changes to forest vegetation in those areas would have negligible effects on migratory bird habitat, but there would be temporary disturbance effects and the potential for unintentional take of some individual birds.

Cumulative Effects

Foreseeable future restoration projects in the Jemez Mountains in combination with restoration activities on adjacent forested land would add to the beneficial effects for migratory birds predicted to result from the project activities. Project activities under all action alternatives (1, 3, 4, and 5) would be spread across the project area, occurring in different locations at different times with no resulting permanent cumulative effects on migratory birds.

Foreseeable future forest restoration projects in the Southwest Jemez Mountains are expected to alter the current trend of increasingly large and severe wildfires. Future projects including mechanical treatments, riparian, and instream habitat improvement, and prescribed fire would magnify the improvements to habitat expected from the proposed actions and expand those benefits in a broader landscape. Habitat conditions would become increasingly more structurally complex and biologically diverse, with abundant herbaceous plants in scattered openings and greater dominance by large, fire-adapted trees. Improvements in nesting, roosting, prey base, and foraging habitat would be better distributed across the landscape.

The primary cumulative effects would be the reduced probability of a large, severe crown fire and the return of periodic low to moderate-intensity surface fires that improve habitat for species that evolved in these fire-adapted forests. There could be some temporary cumulative effects in areas where proposed landscape restoration projects occur in conjunction with other forest projects or activities, such as pumice mining. There could be a temporary increase in vehicle activity on roads resulting in increased noise and visual disturbance. These are short-term temporary effects and would not be expected to impact overall populations or habitat trends.

Bald and Golden Eagle Protection Act

Affected Environment

The Bald and Golden Eagle Act (Eagle Act), passed in 1940, prohibits the take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16U.S.C 668(a); 50 CFR Part 22)). All golden and bald eagles are protected under the Eagle Act.

Environmental Consequences

All Alternatives

This analysis must determine if take is likely to occur with implementation of the action alternatives. Effects on bald and golden eagles from each of the alternatives would be the same as the effects previously described for the threatened, sensitive, and MIS bird species. Alternative 2 would have little to no effect because the proposed activities would only be implemented in the Paliza area.

No unintentional take would occur from project activities because eagles are not currently roosting or nesting in the project area. The action alternatives would likely increase foraging habitat and habitat complexity without reducing the mature tree component. Short-term effects are anticipated to be minimal because sufficient habitat exists on neighboring forest and Valles Caldera National Preserve lands.

Chapter 4. Consultation and Coordination

Preparers and Contributors

Following is a list of the key interdisciplinary team of specialists who substantially contributed to the preparation of this Draft Environmental Impact Statement." There were many other specialists who provided valuable assistance in preparation of this document, as reviewers, consultants and administrative support staff.

Name	Position	Contribution
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Armstrong, Bill	Fuels Specialist	Fuels
Bremer, Mike	Forest Heritage Program Manager	Heritage and Cultural Resources
Bueno, Anita	Landscape Architect	Scenery
Carabajal, Abie	Fire Ecologist	Fuels
Cohn, Patricia	Writer-Editor	Writing and Editing, Social Science, Environmental Justice
Constan, Connie	Assistant Archaeologist	Cultural Resources
Cook, Chantel	Forest Fish Biologist	Fisheries and Aquatic
Cramer, Jennifer	Forest Planner	Forest plan amendments
Carril, Dennis	Forest Ecologist	Fuels
Dobb, Jennifer	Economist	Economic Analysis
Downing, Tim	GIS Specialist	Geographic Information Systems, Databases, and Mapping
Dyer, Jennifer	Archaeologist	Cultural Resources
Gallegos, Alicia	Range Specialist	Rangeland Resources, NonNative and Invasive Plant Species
Hall, Joshua	State Air and Water Quality Liaison	Air Quality
Harrelson, Lee	Forest Engineer	Roads and Engineering
Harrelson, Sue	Silviculturist	Vegetation
Harris, Jeff	Recreation Staff	Recreation
Holliday, Kiernan	Civil Engineer	Roads
Kelardy, Shannon	Natural Resource Specialist	Assistant Team Leader
Lawrence, David	Forestry Program Manager, Silviculturist	Vegetation
Luetzelschwab, Julie	Forest Resource Information Coordinator	Geographic Information Systems, Databases, and Mapping
Napp, Chris	Forester	Team Leader
Sanchez, Raul	Wildlife Biologist	Wildlife, Fish, Rare Plants
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Federal, State, and Local Agencies Consulted:

Shaula Hedwall, U.S. Fish and Wildlife Service

State Historic Preservation Office

Tribes

The following tribes and tribal chapters have historic ties and an interest in the Santa Fe National Forest were consulted with and include:

Pueblo of Cochiti

Pueblo of Jemez

Jicarilla Apache Nation

Jicarilla Apache Nation

Mescalero Apache Nation

Pueblo of Nambe

Pueblo of Picuris

Pueblo of Pojoaque

Pueblo of San Felipe

Pueblo of San Ildefonso

Ohkay Owingeh

Pueblo of Santa Clara

Kewa Pueblo

Pueblo of Taos

Pueblo of Tesuque

Pueblo of Zia

The Hopi Tribe

Apache Indian Tribe of Oklahoma

Comanche Nation

List of Agencies, Organizations and Person to Whom Copies of the DEIS Were Sent

Federal

Advisory Council on Historic Preservation, Director, Planning and Review, Washington, DC

APHIS PPD/EAD, Riverdale, MD

NRCS, National Environmental Coordinator, Washington, DC

National Agricultural Library, Acquisitions and Serials Branch, Beltsville, MD

NOAA Fisheries Service SW Region, Long Beach, CA

U.S. Army Corps of Engineers, San Francisco CA

Chief of Naval Operations and Environmental Readiness Division

U.S. EPA, Region 6, Dallas, TX

OEPC, Department of Interior, Director, Washington, DC

U.S. Coast Guard, Office of Environmental Management, Washington, DC

FAA, Southwest Region, Worth, TX

FHA, Division Administrator, Santa Fe, NM

DOE, NEPA Policy & Compliance, Washington, DC

USDI Fish and Wildlife Service, Flagstaff, AZ

NOAA Office of Policy and Strategic Planning, Washington, DC

USGS, Jemez Mtns Field Station, Los Alamos, NM

Los Alamos National Lab, Los Alamos, NM

Bandelier National Monument, Los Alamos, NM

Natural Resource Conservation Service, Cuba, NM

Valles Caldera Trust, Jemez Springs, NM

BIA, Albuquerque, NM

State

New Mexico State Forestry, Santa Fe, NM

New Mexico Environmental Department, Santa Fe, NM

NM Department of Game and Fish, Santa Fe, NM

Fenton Lake State Park, Jemez Springs, NM

New Mexico Air Quality Bureau, Santa Fe, NM

New Mexico House of Representatives, Jeff Hall, Santa Fe, NM

New Mexico State Legislature, Nick Salazar, Santa Fe, NM

Local

Village of Jemez Springs, Mayor, Jemez Springs, NM

Sandoval County Manager and Commissioners, Bernalillo, NM

Rio Arriba County, Espanola, NM

Individuals

Numerous individuals on the project mailing list will receive notification of the availability of the DEIS.

Glossary

Adaptive management: provides an implementation tool that goes beyond the "predict-mitigate-implement" model and incorporates an "implement-monitor-adapt" strategy that provides flexibility to account for inaccurate initial assumptions, to adapt to changes in environmental conditions or to respond to subsequent monitoring information that indicates that desired conditions are not being met (Forest Service 1909.14.1).

Age class: a distinct aggregation (grouping) of trees originating from a single natural event or regeneration activity commonly consisting of trees of similar age. SAF

Aspect: the direction in which a slope faces.

Average tree diameter: The average tree diameter, at breast height (4.5 feet), of all trees in a given area.

Basal area (BA): the area of a cross-section of a tree, including bark, at breast height. Basal area of a forest stand is the sum of the basal areas of all individual trees in the stand, usually given as square feet per acre or square meters per hectare. It is a measurement of how much of a site is occupied by trees. SAF

Best management practices (BMPs): guidelines or minimum standards for proper application of forestry operations, designed primarily to prevent soil erosion and water pollution, and to protect certain wildlife habitat values in riparian and wetland areas.

Biodiversity: the variety, distribution and abundance of living organisms in an ecosystem. Maintaining biodiversity is believed to promote stability, sustainability and resilience of ecosystems.

Biomass: the wood product obtained (usually) from in-the-forest chipping of all or some portion of trees including limbs, tops, and unmerchantable stems, usually for energy production.

Board foot: a unit of unfinished wood 1 inch thick, 12 inches long, and 12 inches wide. A traditional unit for measuring and selling solid wood products (e.g., lumber). One board foot contains 144 cubic inches of wood.

Bole: the main stem of a tree.

Broadcast burn: a type of prescribed fire where the burn is intentionally lit so that the fire will spread across the surface of the landscape, sometimes under residual trees, to meet resource objectives.

Browse: woody vegetation that animals use for food.

Browsing: the consumption of leaves and shoots from woody plants. Contrast with grazing, or consumption of non-woody plants.

Brush: usually refers to shrubs and similar low growing vegetation.

Buffer: an area of specified width where certain activities may not occur. Buffers are usually defined around special sensitive resources such as rare plants or archeological sites, or along each side of a stream, or near other features to be protected from human disturbance.

Canopy: the more or less continuous cover of leaves and branches in a forest, usually formed by the crowns of the dominant and co-dominant trees.

Canopy cover or closure (percent): the percentage of a given ground area that is covered by the vertical projection of the crowns of trees. Also, the amount that tree canopies interlock and cover the ground surface with shade.

Chain: a unit of linear measure that is equal to 66 feet in length.

Closed road: A road placed in storage between intermittent uses. The period of storage must exceed 1 year. These roads are not shown on motor vehicle use maps. They are closed to all vehicular traffic but may be available and suitable for nonmotorized uses. A closed road is not the same as an obliterated or decommissioned road. A closed road may be opened again for use at some time in the future. (Southwestern Region Transportation Glossary)

Clump: A tight cluster of two to five trees of similar age and size originating from a common rooting zone that typically lean away from each other when mature. A clump is relatively isolated from other clumps or trees within a group of trees. A stand-alone clump of trees can function as a tree group.

Co-dominant tree: a tree with its crown in the upper level of the canopy of surrounding trees and receiving direct sunlight from above and comparatively little sunlight from the sides. See also *dominant* and *suppressed*.

Commercial treatments: forestry operations, such as thinning or other timber harvest, that generate income from the sale of removed trees or other products.

Community: an assemblage of plant or animal species, dependent on each other, and constituting an organized system or population.

Competition: the process in which organisms with similar requirements contend for resources—light, water, nutrients, and space—that are in limited supply.

Conifer: any tree that produces seeds in cones, with no fruit structure around the seed. Leaves are usually needles, scales, or narrow and linear in shape, and evergreen.

Contained fire: a fire surrounded by a fuel break that keeps the fire within a specific perimeter area. Fuel breaks may include natural barriers like water or rocks, or manually or mechanically constructed lines where vegetation is cleared away.

Controlled burn: prescribed fire

Cooperating agency: A federal, state, or local agency or tribe that has jurisdiction and that may be affected by the proposed federal project and provides support and assistance in completing the environmental analysis for a project in accordance with National Environmental Policy Act regulations.

Cord: a pile of wood 4 feet high, 4 feet wide, and 8 feet long, with a volume of 128 cubic feet. Actual volume of solid wood in a cord will vary from 60 to 100 cubic feet, depending on size of individual pieces, bark thickness, and orderliness of stacking.

Cordwood: small diameter or low quality wood suitable for firewood, pulp, or chips; not sawlogs.

Cover (wildlife): the protective element within an animal's habitat, which provides concealment from predators (hiding cover) and shelter from the weather (thermal cover). Cover takes many forms, including patches of dense brush, tall grasses, the forest canopy, or other landscape features.

Creeping fire: fire burning with a low flame and spreading slowly.

Crown: the portion of an individual tree above the main stem, consisting of live branches and foliage.

Crown fire (crowning): a fire that burns and moves through the uppermost branches (crowns) of trees and spreads from crown to crown. Fire burning in the crowns of trees is an indicator of a high intensity wildfire.

Crown spacing: the distance between the uppermost branches of individual mature trees within a stand. Crown spacing distance, along with the pattern in which trees are spaced (even vs. uneven), are indicators of how easily a crown fire can spread within a stand.

Crown to base height: the vertical distance from the lowest live branch or whorl on a tree to the ground.

Cubic foot (cf): a unit of measure for the volume of wood products, equivalent to the volume of a cube that measures one foot on each side. CCF refers to 100 cubic feet of volume.

Defensible space: an area where the flammable vegetation has been treated (reduced or cleared away) so the area acts as a barrier to the advancing wildfire and loss to life, property or resources.

Den tree: a tree with cavities that provide shelter and nesting sites for various wildlife species.

Desired condition: a portrayal of the land and resource conditions that are expected to result if goals and objectives are fully achieved.

Diameter at breast height (dbh): diameter of the tree bole at 4.5 feet above ground level.

Diameter at root collar (drc): diameter of the tree bole at the base of the tree.

Disturbance: any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment, such as a wildfire, windstorm, insect or disease attack, or flooding.

Dominant tree: a tree with its crown extending above the general level of the canopy of surrounding trees, and receiving full sunlight from above and partly from the sides.

Drip torch: hand-held device for igniting fires by dripping flaming liquid fuel on the materials to be burned; consists of a fuel fount, burner arm, and igniter. Fuel is usually a mixture of diesel and gasoline.

Duff: the layer of decomposing organic materials lying below the litter layer of the freshly fallen twigs, needles and leaves, and above the mineral soil.

Ecological restoration - The process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. Restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions (USDA Forest Service 2008).

Ecosystem: a complex of interacting organisms (plants, animals, fungi, bacteria, etc.) together with its environment, considered as a unit.

Ecosystem sustainability: the capacity of an ecosystem for long-term maintenance of ecological processes and functions, biological diversity, and productivity.

Edge effect: the increased richness of plants and animals that occurs in areas where two or more habitat types come together.

Encroachment: expansion of coniferous forests into meadows or aspen stands due to fire exclusion, grazing, climate change or other disturbance or management practice that disrupts natural succession processes.

Endangered: in danger of extinction throughout all or a significant portion of its range.

Erosion: the wearing away of the land surface by rain or irrigation water, wind, ice, or other natural or anthropogenic agents that abrade, detach and remove geologic parent material or soil from one point on the earth's surface and deposit it elsewhere.

Even-aged stand: A stand of trees composed of a single age class in which the range of tree ages is usually ±20 percent of rotation age (SAF 2008).

Escaped fire: a fire that has exceeded or is expected to exceed the prescribed fire prescription.

Even-aged stand: a stand of trees composed of a single age class in which the range of tree ages is within 20% of rotation (harvest) age.

Exclosure: a fenced area, generally of limited extent, enclosing vegetation and keeping out livestock or wildlife.

Extreme fire behavior: A level of fire behavior that ordinarily precludes direct control action. It usually involves a high rate of spread, prolific crowning or spotting, and possibly some fire whirls or a strong convection column. Predictability and control are very difficult.

Felling: the cutting of standing trees.

Fine fuels: fast-drying fuels usually less than ¼ inch in diameter and having a timelag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Fire adapted ecosystem: an associated group of plant and animals that have made long term genetic changes in response to the presence of fire in their environment.

Firebreak: a natural or constructed barrier or discontinuity of fuels used to stop or check fires or that provides a control line from which to work in managing a fire.

Fire intensity: a term related to the heat energy released during a fire.

Fireline: a linear fire barrier that is scraped or dug to mineral soil that is used to stop or control the spread of fires.

Fire regime: long-term pattern of fire behavior across a given landscape and vegetation community. Fire regimes are classified in terms of frequency (average number of years between fires) and severity (amount of replacement of the overstory vegetation).

Fire Regime Condition Class (FRCC): a measure of the degree of departure (gap) between existing conditions and reference conditions in relation to fire regimes.

Fire severity: a term related to the environmental impacts caused by a fire.

Flame length: the height of flames from a wildfire or prescribed fire, above the ground surface.

Forage: Browse and herbage that is available and can provide food for animals or be harvested for feeding, or to search for or consume forage.

Forest Stewardship Program: a program funded by the U.S. Forest Service to encourage private forest landowners to practice sustainable, multiple-use land management. Cost-share assistance is available for approved conservation practices.

Forage: woody or non-woody vegetation such as grasses, forbs and shrubs that are eaten by wildlife and/or livestock.

Forb: a plant with a soft rather than woody stem that is not a grass.

Forest cover type: a classification of forest land named after the most dominant tree species.

Forest fragmentation: the splitting of forest lands into smaller, detached areas as a result of road building, farming, suburban development, and other activities.

Fuel: combustible living and dead material including vegetation such as trees, shrubs, grasses, snags, down logs, tree needles, and other leaf litter that feeds a fire.

Fuelbreak: a strip or patch of land maintained clear of trees and tall brush.

Fuel model: a description of fuels within an area that helps managers describe or simulate how a fire might behave, given other factors that can influence fire behavior (weather and topography). Fuel Models 1 and 2 describe areas where grasses are the dominant ground fuels. Fuel Model 6 describes an area dominated by understory and mid-story shrubs and immature trees. Fuel Model 9 describes a stand where ground fuels are dominated by forest litter (pine needles and leaves).

Gap: 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.

GIS (Geographic Information Systems): computer system used to store, organize and display geographic information spatially, such as roads, streams, soil types, or any other feature that can be mapped on the ground.

Ground cover: all herbaceous plants and low growing shrubs in a forest or open area.

Group: A cluster of two or more trees with interlocking or nearly interlocking crown as maturity surrounded by an opening. The size of tree groups is variable and depends on the forest community and sited conditions. Trees within groups are not uniformly spaced and trees may be tightly clumped.

Habitat: the environment in which a plant or animal lives.

Habitat diversity: the variety of wildlife habitat features and types in a specific area.

Habitat type: A system 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.

Hardwood: tree species in the angiosperm group (the flowering plants that produce seeds enclosed in a fruit). Hardwood trees are characterized by broad leaves as opposed to needles.

Harvest: cutting and gathering a tree crop for utilization. In a forest harvest, trees are felled and moved to a central location (landing) for final transport by trucks.

Herbaceous vegetation: non-woody plants, for example, grasses, forbs, wildflowers and ferns.

Herbicide: a chemical for killing unwanted plants.

Home range: the area an animal uses to satisfy its normal requirements for food, water, and cover.

Hydrologic Unit Code: a sequence of letters or numbers that identifies a hydrological feature such as a lake, river reach or watershed. Hierarchical classification system that identifies a particular hydrologic drainage basin.

Integrated pest management (IPM): the use of different techniques in combination to control pests, with an emphasis on methods that are least injurious to the environment and most specific to the particular pest.

Intermediate thinning: the thinning or cutting of trees to improve the composition, structure, condition, health, and growth of remaining trees. (SAF 1998).

Interspaces: the open space between tree groups intended to be managed for grass-forb-shrub vegetation during the long term. Interspaces may include scattered single trees.

Invasive plants or noxious weeds: plants that possess one or more of the following attributes: aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier of serious insect or disease, and may or may not have been part of a native plant community.

Karst: topography with sinkholes, caves, and underground drainage that is formed by dissolution in limestone, gypsum, or other rocks.

Ladder fuels: vegetation fuels that provide vertical continuity, thereby allowing fire to carry from surface fuels into the crowns of trees with relative ease. They help initiate and assure crowning.

Landing: a central location where logs are gathered for transport to the mill.

Large tree: a tree with diameter 16” or larger, regardless of age.

Litter: the uppermost layer of organic debris on a forest floor, composed mainly of fresh or slightly decomposed leaves, bark, twigs, flowers, fruits, and other vegetable matter.

Live fuels: Living plants that are combustible such as trees, grasses and shrubs.

Log: section of the main stem of a harvested tree.

Mast: the flowers, fruits or seeds of plants, especially of trees and shrubs that are eaten by animals. Hard mast includes hard-shelled seeds such as acorns or nuts. Soft mast includes flowers and seeds with a fleshy cover, for example berries and seeds.

Mastication: reducing forest vegetation in the stand by grinding, shredding, or chopping woody material. Typically done with a masticator, shredder, or chipper machine.

Mature tree: a tree that has attained most of its potential height growth.

Mechanical treatment: cutting and removing trees using chain saws, feller-bunchers, and skidders

MBF: abbreviation signifying 1,000 board feet of wood volume.

Montane: referring to the climate, ecosystems, or species found in mountains.

Mosaic - the spatial arrangement of habitat where there is stand heterogeneity—measured at many spatial scales from the patch, the stand, and the vegetative community

NEPA: National Environmental Policy Act.

Nonnative invasive species: plant or animal 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.

Non-point source (NPS) pollution: effluent sediments or chemicals that enter a water body in a diffuse manner (e.g., runoff or leaching from farms, forestry operations, or urban areas), rather than from a specific point such as a pipe. Use of BMPs or filter strips helps prevent NPS pollution.

Old growth: a late stage of forest succession beyond the age of biological maturity, or stands that contain old growth characteristics including numerous large trees, large snags, and logs on the ground (attributes defined in the forest plan).

Operational road maintenance levels: level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria (FSH 7709.58, 12.3). There are five levels:

Level 1: These are roads that have been placed in storage between intermittent uses. The period of storage must exceed 1 year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs.

Level 2: Assigned to roads open for use by high-clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations.

Level 3: Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car.

Level 4: Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced.

Level 5. Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities.

Out-of-Whack: something is out of order or alignment, not in proper condition.

Over-mature tree: a tree that has reached that stage of development when it is declining in vigor and health and reaching the end of its natural life span. Indications of later life stages in southwestern ponderosa pine include yellowing bark, large limbs, dead and/or dying limbs, flat tops, snag tops, lightning scars, and burn scars (cat face).

Overstocked: a stand in which trees are so closely spaced that they are competing for required resources, resulting in less than full growth potential for individual trees.

Overstory: the trees in a forest of more than one story that form the upper canopy layer.

Particulate matter: the microscopic particles that are part of smoke.

Perennial stream: a stream that flows throughout most (greater than 50 percent) of the year

PFA: goshawk post-fledgling family area

Pole: a tree of a size between a sapling and a mature tree.

Pre-commercial thinning: the removal of trees not for immediate financial return but to reduce stocking to concentrate growth on the more desirable trees.

Prescribed fire: a fire ignited by management actions under specified environmental conditions and following appropriate precautionary measures to achieve specific objectives. Prescribed fires are typically conducted in the spring or fall when temperatures are cool, humidity is high, and fire behavior is moderate. Prescribed fires are monitored by firefighters to ensure they remain within the area designated for burning.

Prescription: a schedule of activities for a stand or forest property which, when carried out, should produce the outcome desired by the landowner.

Protected habitat (Mexican spotted owl) – Protected habitat consists of projected activity centers (PACs), slopes greater than 40 percent where timber harvest has not occurred in the last 20 years (steep slopes), reserved lands which include wilderness, research natural areas, wild and scenic rivers, and congressionally recognized wilderness study areas. The primary objective for protected habitat is the protection of the best available habitat for Mexican spotted owls while retaining management flexibility to abate high fire risk and to improve habitat conditions for the owl and its prey.

Reference condition: the scientific approximation of the natural or historical range of variation of landscape vegetation and disturbance (e.g. fire) of an ecosystem that existed prior to European settlement.

Regeneration: the replacement or renewal of a forest stand by natural or artificial means. Also, the term “regeneration” may refer to the young tree crop itself.

Release: freeing a tree or group of trees from competition by removing trees or shrubs that overtop or crowd them.

Residual stand: trees remaining uncut following any cutting operation.

Resiliency: the capacity of a (plant) community or ecosystem to maintain or regain normal function and development following a disturbance.

Restricted habitat (Mexican spotted owl):

Restoration: the process of returning ecosystems or habitats to their original structure and species composition.

Riparian zone or ecosystem: the land and vegetation bordering flowing or standing water, identified by distinctive saturated soil characteristics and vegetation that require water (streams, lakes, ponds).

Road decommissioning. (1) Activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212.1). (2) Activities that result in restoration of unneeded roads to a more natural state (FSM 7705, FSM 7734).

Road obliteration. To deconstruct, decommission, deactivate, or dismantle a road; the denial of use, elimination of travelway functionality, and removal of the road from the forest development road system; return of the road corridor to resource production by natural or designated means (“A Guide for Road Closure and Obliteration in the FS,” June 1996, T and D Publication 9677 1205).

Running or active fire: A rapidly spreading fire with a well-defined head.

Sapling: a tree that is no longer a seedling but not yet a pole, usually at least 4.5 feet tall and 1 to 4.9 inches in diameter.

Sawtimber: trees, or logs cut from trees, with a minimum dbh of 8 inches, and with stem quality suitable for conversion to lumber. Small sawlog trees (dbh 8 to 14 inches) and large sawlog trees (dbh over 14 inches) sometimes are distinguished.

Sedimentation: the filling-in of stream channels or water bodies with soil particles, usually as a result of erosion on adjacent land.

Seedling: a young tree, usually less than 3 feet high and less than 1 inch in diameter.

Sensitive species: plant and animal species identified by a regional forester for which population viability is a concern as evidenced by significant current or predicted downward trends in population or habitat capability that would reduce a species' distribution.

Seral: a temporal and intermediate stage in the process of succession.

Shade tolerance: the ability of a tree species to survive in relatively low light conditions, although it may not thrive. Shade-intolerant species require sunlight to establish and grow. Shade-tolerant trees grow well in shady conditions.

Silviculture: the art, science, and practice of establishing, tending, and reproducing forest stands.

Site: the combination of biotic, climatic, topographic and soil conditions of an area.

Skidder: specialized logging equipment used to slide logs from stump to landing. Skidders are typically rubber tired or track mounted. Some are modified tractors equipped with either cable and winch, or a hydraulic grapple.

Skidding: moving trees from the felling site to a landing, using tractors or other logging equipment.

Slash: branches, treetops, bark, and other woody material left on the ground as a byproduct of thinning (activity produced slash).

Snag: a standing dead or dying tree that has lost most of its branches.

Soil productivity: the capacity of a soil to produce a specific plant or sequence of plants under a specific system of management.

Stand: a group of trees sufficiently uniform in species composition, structure and spatial arrangement to be distinguished from surrounding groups of trees.

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.

Stand density index (SDI): a relative measure of competition in a forest stand based on number of trees per unit area and average tree size.

Stand structure: the presence, size, and physical arrangement of vegetation in a stand. Vertical structure refers to the variety of plant heights from the canopy to the forest floor. Horizontal structure refers to distribution of trees and other plants across the land surface.

Stump height: the distance between ground level and the top of a stump.

Succession: the ecological process of sequential replacement by plant communities on a given site as a result of reproduction and competition.

Suppressed trees: trees with crowns below the general level of the canopy and receiving no direct sunlight. Suppressed trees are characterized by low growth rate and low vigor due to competition with overtopping trees.

Surface fire: a fire that burns over the forest floor, consuming litter, killing aboveground parts of herbaceous plants and shrubs, and typically scorching the bases and crowns of trees.

Surface fuel: fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

Sustainability: a characteristic of a process or state that can be maintained indefinitely. Sustainable land management has often been defined as that which meets the needs of the present without compromising the ability of future generations to meet their own needs.

Temporary road or trail - A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a forest transportation atlas (36 CFR 212).

Thinning: removing some trees in a forest stand to provide growing space for other trees, and/or to remove dead or dying trees to reduce pest problems.

Thinning from below: a method of thinning that involves cutting the smallest trees in the stand up to a specified diameter limit. Also called “low thinning.”

Threatened: likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Torching: fires igniting and flaring up from the bottom to the top of a tree or group of trees.

Treatment: any silvicultural practice or procedure.

Underburn: a prescribed fire that burns mostly surface fuels although it may cause some torching in trees or groups of trees.

Understory: trees and other vegetation that grows beneath the overstory of a forest stand. Understory vegetation usually consists of grasses, forbs, and herbs; shrubs, bushes and brush; and small immature trees (saplings).

Uneven-aged stand: a group of trees of a variety of ages and sizes and often of different species.

Upland: areas away from coastlines and the floodplains of streams, creeks, rivers, and other bodies of water.

Upland function: the ability of the uplands to allow for the retention of precipitation and maintain and improve soil condition

Variable density thinning: thinning a forested stand by following a regime in which the remaining tree density is deliberately varied throughout the stand.

Wildlife habitat: the arrangement of food, water, cover and space required to meet the biological needs of an animal. Different wildlife species have different habitat requirements.

Waterbar: a ditch or hump constructed diagonally across trails or roads to reduce soil erosion by diverting surface water runoff into adjacent ditches or vegetation.

Watershed: the total land area from which water drains into a particular stream or river.

Well stocked: the stand density at which trees are spaced widely enough to prevent competition, yet closely enough to fully use site resources.

Wetlands: lowlands covered with shallow, and sometimes temporary, water. The frequency and duration of inundation is sufficient to support plant communities that typically are adapted for life in saturated soils.

Wildlife corridors: strips of trees, shrubs, and understory vegetation that provide cover and habitat for wildlife and that serve as travel lanes for movement across open areas and between isolated patches of habitat.

Woodland: a forest with low tree densities, often defined as less than 20 to 30 percent crown cover when trees are mature.

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Appendix A. Design features, best management practices, mitigations and monitoring for alternatives 1, 3, 4, and 5

All Activities

Type: **Design Feature**

Purpose: **The cumulative watershed effects analysis will provide the ‘hard look’ required by NEPA and provide the decision-maker with the best available science.**

1. Use suitable tools to analyze the potential for cumulative watershed effects to occur from the additive impacts of the proposed project and past, present, and reasonably foreseeable future activities on National Forest System and neighboring lands within the project watersheds. This analysis will use the Equivalent Disturbed Area-Equivalent Roaded Area (EDA/ERA) method.

Type: **Best Management Practices**

Purpose: **To minimize impacts to soil and water resources, to minimize non-point source pollution, to adhere to the Clean Water Act, and to adhere to the agreement between the Southwestern Region of the Forest Service and the New Mexico Environment Department.**

2. Implement best management practices (BMPs) and design criteria for those actions requiring non-point source and point source water quality through the iterative process of monitoring and adjusting BMPs and water quality standards.

Air Quality and Smoke Management

Type: **Design Feature**

Purpose: **To reduce emissions.**

For Prescribed Burns:

1. Follow all requirements listed in the New Mexico State Smoke Management Regulations, including coordination requirements with New Mexico Environmental Department’s Air Quality Bureau (AQB). The AQB will facilitate coordination with agencies to ensure that burning does not occur on the same days as other prescribed burns that may impact the same areas, and to avoid exceeding air quality or visibility standards, in accordance with Clean Air Act requirements.
2. Notify potentially affected communities, other agencies, fire departments, campground visitors, Jemez Pueblo, and others, in advance of and during the burn activities.

3. Include specific smoke management (emission reducing) objectives and measures in burn plans, including the use of backing fires, aerial ignitions, and other methods known to reduce emissions (Hardy et al. 2001).
4. Burning will occur during times of relatively high fuel moistures in the larger fuels so that they are not consumed; this can reduce emissions by 43% (Hardy et al. 2001).
5. Do not burn when ventilation is considered poor, below 20,000 knot-feet, for the entire day[35]. Stop ignitions before nightfall to allow for good ventilation and smoke clearing at night. Avoid situations that lead to overnight active fire behavior.
6. Monitor meteorological conditions, smoke dispersion and emissions, before and during prescribed burning, and coordinate with the State Environment Department to determine whether to stop ignitions or take other corrective actions if air quality standards are exceeded or public health or safety is compromised by smoke.
7. Plan individual burn blocks so that ignitions will not exceed 3 days, not including black lining.

Cultural Resources

Type:	**Design Feature**
Purpose:	**These are overall design features for all sites and are derived from typical practices.**

For all sites:

1. Sites listed on the National Register of Historic Properties will receive priority for treatment. Sites that are not eligible for listing on the National Register of Historic Properties will be documented, but not treated.
2. The existing road system will be used to access sites.
3. Prescribed burning of archaeological sites will be implemented at the same time as the landscape restoration burning, provided heavy fuels are removed from sites prior to burning.

[35] Ventilation is the atmospheric potential to disperse airborne pollutants. It is calculated by multiplying the mixing height by the transport wind speed. 20,000 knot-feet is approximately 23,000 mph-ft.

Type:	**Design Feature**
Purpose:	**These design features are specific to archaeological sites in ponderosa pine and mixed conifer forests. They are derived from typical practices used in fuels removal from cultural sites and resources.**

For archaeological sites in ponderosa pine and mixed conifer vegetation types:

4. Remove dead and down logs that are lying on the site, especially those in direct contact with rubble mounds. Old, decomposing logs will not be removed during monsoon season or when the ground is wet.
5. Cutting will be done with chainsaws. Do not use mechanical ground disturbing equipment.
6. Use directional felling to keep trees from falling on rubble mounds.
7. On rubble mounds, cut all trees less than 16-inches diameter. Use professional judgment on trees 16-24-inches in diameter. Leave most trees greater than 24-inches diameter, which would survive a fire.
8. Cut stumps flush to the ground. On artifact scatter around the rubble mounds, thin trees to a 20 foot spacing. Favor leaving trees larger than 16-inches diameter.
9. In ponderosa pine and mixed conifer, favor leaving ponderosa pine over other tree species.
10. In ponderosa pine and mixed conifer, cut all piñon and juniper.
11. Prune trees up to 4 feet above ground level.

Slash Treatments:

12. Generally, do not make slash piles within site boundaries unless directed by the district archaeologist.
13. Slash will be hand-carried outside of the site boundary or to an area designated by the district archaeologist.
14. If there is a small amount of slash, scatter it so that the slash is less than 2-feet high. If there is too much slash to scatter, pile slash in a location determined by the district archaeologist. Slash piles will be burned at a later time or chipped.
15. Utility vehicles (UTVs) may be used outside the site boundary and on existing 2-track roads or UTV trails within the site boundary if approved by the district archaeologist. Do not create new UTV trails or 2-track roads.
16. Spread slash in areas with active erosion. Place logs on the contour and away from site features or areas with artifacts. Remove branches so that the log will be in contact with the ground surface and decompose more quickly.

Type:	**Design Feature**
Purpose:	**These design features are specific to archaeological sites in the piñon-juniper woodlands. They are derived from typical practices of fuels removal from cultural sites and resources and erosion prevention techniques.**

Archaeological sites in piñon-juniper vegetation types:

17. Cut all trees on rubble mounds except datum tree. Prune the datum tree to 4-feet above ground level.
18. Cutting will be done with chainsaws. Do not use mechanical ground-disturbing equipment. Use directional felling to keep trees from falling on rubble mounds.
19. Around the rubble mounds, cut trees to a 10-foot spacing (between outside edge of crowns).

Slash:

20. Place slash over rills, headcuts, erosional areas, sheeting outside the site boundary. Small amounts of slash can be strategically placed in headcuts inside site boundaries as directed by district archaeologist. When possible, scatter slash instead of making piles. Chipping is acceptable.
21. Follow UTV guidelines for ponderosa pine and mixed conifer vegetation types above

Type:	**Mitigation**
Purpose:	**Items 1-2 are standard mitigations for all work in areas that contain archaeological sites. Item 4 is part of the phased approach that is allowed through the Region 3 Programmatic Agreement. Items 5 and 6 are mitigation measures specific to the Southwest Jemez Landscape Restoration Project.** **Items 7-8 are derived from Appendix J of the Region 3 Programmatic Agreement, which is the standard protocol for large-scale fuels reduction, vegetation treatment, and habitat improvement projects.** **Items 9-13 are derived from Appendix E of the Region 3 Programmatic Agreement, which is the standard protocol for routine road maintenance, road closure, and road decommissioning.** **Items 14-19 are associated with the design criteria for treatments in archaeological sites also presented in this table. These mitigations are specific to the treatment of archaeological sites, but will be conducted in parallel with prescribed fire and mechanical treatments.**

For all activities:

1. Mark all archaeological sites on-the-ground for identification purposes using white flagging tape or white paint to delineate the boundary to ensure that all mitigation measures can be applied. The site datum or reference tree will be marked with three horizontal bands.
2. Within archaeological site boundaries, avoid any ground-disturbing activity, including commercial thinning (i.e. timber sales), construction of fire lines, mop-up actions, slash piling, staging or turnaround of heavy equipment, staging of materials, or use of mechanized or ground-disturbing equipment.
3. If previously unidentified cultural materials are discovered during implementation, cease working in the area until Forest Service archaeologists have been notified and approve restarting the work.
4. Initiation of work in any phase of the project will be contingent upon completion of the identification and protection of historic properties and compliance with applicable provisions of the National Historic Preservation Act in accordance with the Standard Consultation Protocol, including consultation with Native American Tribes.
5. In areas where only prescribed burning or only mechanical thinning may occur, brush and remove dead fuels for a distance beyond site boundaries in order to reduce the intensity of prescribed fires or wildfires in the area. The treatment would be sufficient to reduce fire effects to cultural resources to the level of a low intensity fire depending on site specific conditions as determined by a professional archaeologist with experience in fuels treatment to reduce fire effects.
6. After prescribed fire is used, monitor the areas around sites for fire-killed trees that need to be felled away from the archaeological sites.

For prescribed burning:

7. Avoid fire ignition points within boundaries of fire-sensitive archaeological sites (i.e. sites with wooden features, rock art, cliff dwellings, etc.). Provide aerial ignition pilots with GPS locations of specific fire-sensitive sites and large pueblo sites to avoid when conducting aerial ignitions.
8. Protect fire-sensitive sites using the following methods: lining, back burning, foaming, and/or otherwise insulating wooden features, in addition to removing heavy fuels. Monitor fire-sensitive sites subsequent to burning and modify protection measures if effects are documented.

For road maintenance and road decommissioning:

9. Conduct limited testing within the road prism to determine whether the road has cut below the cultural deposits of a known archaeological site.
10. Restrict vehicular traffic to the existing road prism within known archaeological sites to protect intact cultural deposits that lie outside the road prism.
11. Place temporary fencing to keep equipment out of known archaeological site boundaries.
12. Close or gate roads to protect archaeological sites.

13. Prohibit road maintenance activities within site boundaries unless limited testing demonstrates the road has cut below cultural deposits and consultation on effect has been completed.

For treatments conducted within archaeological site boundaries:

14. All treatments will be conducted with district or forest archaeologist oversight and/or monitoring.
15. Cut trees using chainsaws only.
16. Fell large diameter trees away from all features.
17. Remove fuels from sites by hand carrying.
18. Do not drag logs, trees, or thinned materials across or through sites and features.
19. Allow prescribed fire to burn over non-fire-sensitive sites, provided heavy fuels are removed prior to burning.

Type:	**Monitoring**
Purpose:	**Effectiveness monitoring**

Additional monitoring for the effectiveness of treatments would be done throughout the life of the project. Long-term site monitoring would focus on public visitation and vandalism of sites.

Type:	**Monitoring**
Purpose:	**Consultation**

Consult with the tribes to identify traditional cultural properties and traditional use areas before treatments are implemented in a particular area

Fire and Fuels

Type:	**Design Feature**
Purpose:	**To maintain long-term soil productivity and minimize sediment delivery from containment lines.**

1. On areas to be prescribed burned, fire prescriptions should be designed to minimize soil temperatures over the entire area. High intensity fire should occur on 10% or less of the entire area. Fire prescriptions should be designed so that soil and fuel moisture are such that fire intensity is minimized and soil health and productivity are maintained.
2. If containment lines are put in place, rehabilitate lines after use by either rolling berm back over the entire fireline, spreading slash across the fireline or waterbar the fireline. If line is only to be waterbarred, disguise the first 400 feet or past straight line of sight of line to discourage use as a trail

Type:	**Design Feature**
Purpose:	**To maintain long-term soil productivity.**

3. On areas to be prescribed burned, fire prescriptions should be designed to minimize soil temperatures over the entire area. High intensity fire should occur on 10% or less of the entire area. Fire prescriptions should be designed so that soil and fuel moisture are such that fire intensity is minimized and soil health and productivity are maintained.

Type:	**Design Feature**
Purpose:	**In accordance with Forest Service National Core BMPs (2012), Aquatic Management Zones will be used in project planning, analysis, and decision making and will further incorporate BMPs and design features to improve water quality.** **To minimize sediment and/or ash delivery into drainages and maintain water quality**

4. In areas to be prescribed burned, establish filter strips (also known as Aquatic Management Zones). These stream reaches will be designated as protected streamcourses. The following are recommendations to protect streamcourses.

   Riparian streamcourse:

   Severe erosion hazard: 120 feet on each side of streamcourse.

   Moderate erosion hazard: 100 feet on each side of streamcourse.

   Slight erosion hazard: 70 feet on each side of streamcourse.

   Non-riparian streamcourse:

   Severe erosion hazard: 100 feet on each side of streamcourse.

   Moderate erosion hazard: 70 feet on each side of streamcourse.

   Slight erosion hazard: 35 feet on each side of streamcourse.

   Do not ignite fuels within this buffer area. Fire is allowed and expected to creep into the buffer.

Type:	**Design Feature**
Purpose:	**To minimize sediment and/or ash delivery into drainages and maintain water quality. Maintain soil productivity.**

5. Construct drainage structures (waterbars, rolls, dips, armor) along fire containment lines as needed to prevent erosion and runoff.

Type: **Design Feature**

Purpose: **To minimize sediment and/or ash delivery into drainages and maintain water quality. Maintain soil productivity.**

6. A unit that has been mechanically treated (thinned or harvested), will have at least a one-year rest period after the mechanical treatment prior to prescribed fire treatment. (Example: If a unit is mechanically treated in 2014, you cannot burn until 2016).

Type: **Design Feature**

Purpose: **To protect Mexican spotted owls.**

7. In Mexican spotted owl protected activity centers avoid nest areas during prescribed fire operations to the extent possible. Plan ignitions away from the nest area.

Type: **Best Management Practice**

Purpose: **Reduce soil loss and sediment input to streams. Maintain soil productivity and channel function.**

For all prescribed fire treatments:

1. Avoid, minimize, or mitigate adverse effects of prescribed fire and associated activities on soil, water quality, and riparian resources that may result from excessive soil disturbance as well as inputs of ash, sediment, nutrients, and debris into waterways.
2. Conduct prescribed burns to minimize the residence time on the soil while meeting the burn objectives. Manage fire intensity to maintain target levels of soil temperature and duff and residual vegetative cover within the limits and at locations described in the prescribed fire plan. Conduct prescribed fire treatments, including pile burning for slash disposal, in a way that encourages efficient burning to minimize soil impacts.

Type: **Mitigation**

Purpose: **To minimize economic effects on grazing permittees.**

1. No single grazing allotment will be treated with prescribed fire for two consecutive years.
2. When and where possible, take advantage of natural barriers and existing roads to limit soil disturbance and construction of new fires lines.

Gravel Pits

Type: **Design Feature**

Purpose: **Design features specific to project. Minimize effects on recreation use.**

1. Conduct exploratory drilling to determine extent and quality of rock source.

2. The maximum size of a single pit will not exceed 5 acres.
3. To the extent possible rock pits will be located near existing system roads to minimize the need for road construction and reconstruction.
4. No construction of rock pits would take place in the Inventoried Roadless Area, Jemez Wild and Scenic River Corridor, or within the Jemez National Recreation Area.

Harvesting Operations

Type: **Design Feature**

Purpose: **To minimize loss of soil productivity and limit erosion.**

1. The timber sale administrator or contracting officer representative will contact the watershed staff prior to proposed unit closeout to ensure that mechanical equipment remains onsite to implement erosion control measures.

Type: **Design Feature**

Purpose: **To minimize sediment detachment and to minimize impacts on severe erosion soils.**

2. Do not blade roads when the road surface is too dry. If the road surface is too dry, use a water truck to apply water, or the project can be scheduled for when adequate moisture occurs to complete the project.

Type: **Design Feature**

Purpose: **To minimize impacts to streams and soils in meadows from tree harvesting operations.**

3. In meadow restoration sites where wood is being removed, designate skid trails in order to limit skidding. Where material is not being removed, lop and scatter or manually remove slash from meadow; these are the preferred methods of treating slash.
4. No skidding on wet meadows or across live streams or stream channels.
5. Leave sufficient numbers of cut trees (large woody debris) onsite for needed surface flow grade control. Forest watershed personnel will identify locations for large woody debris before works starts and/or inspect large woody debris placement work done by the timber sale administrator or contracting officer representative at unit closeout.
6. Do not machine pile slash and woody debris within meadows.

Type: **Design Feature**

Purpose: **To minimize soil erosion, maintain soil productivity, and to minimize impacts on severe erosive soils.**

7. Place slash on or cross-ditch (waterbar) skid trails and obliterated roads to break the energy flow of water. Placing slash on skid trails is the preferred method. Waterbars are only to be built using equipment with an articulating blade (no skidders) or by hand.
8. Place slash on or cross-ditch (waterbar) skid trails and obliterated roads to break the energy flow of water. Placing slash on skid trails is the preferred method. Waterbars are only to be built using equipment with an articulating blade (no skidders) or by hand.
9. Do not design a long, straight skid that would direct water flow. Locate skid trails outside of filter strips

Type: **Design Feature**

Purpose: **Minimize ground disturbance from skidding operations and to minimize impacts on severe erosive soils.**

10. Require felling to the lead to minimize ground disturbance from skidding operations. Felling to the lead is cutting trees in a predetermined direction within a certain area of the unit based on terrain and the skid road system. This makes it is easier for the skidders to gather and remove the logs and has fewer impacts on the soil.

Type: **Design Feature**

Purpose: **Minimize soil loss and sedimentation of streamcourses from skidding operations and to minimize noxious weed spread and re-establish native vegetation and to minimize impacts on severe erosive soils.**

11. Outline the timing and application of erosion control methods in the sale contract. Seed mix will include certified weed-free native species at a minimum of 12 pounds per acre pure live seed.
12. Use the Santa Fe National Forest Terrestrial Ecosystem Survey to identify potential vegetation for individual sites and seed type needed for revegetation.
13. Use the design features in Forest Service Handbook (FSH 2509.22, Chapter 20.24.22) to minimize soil loss and sedimentation. The preferred erosion control method on skid trails in the harvest areas is spreading slash. Other acceptable erosion control measures include, but are not limited to, waterbarring, removing berms, seeding, mulching and cross-ripping. Waterbars should not be more than two feet deep and need at least a ten-foot leadout. Erosion control after skidding operations must be timely to minimize the effects of log skidding.

Type: **Design Feature**

Purpose: **To minimize soil movement, maintain water quality, and to minimize impacts on severe erosion soils.**

14. Control road drainage with the following methods including, but not limited to: rolling the grade, insloping, outsloping, crowning, water spreading ditches, and contour trenching.

Reduce sediment loads at drainage structures by installing sediment filters, rock and vegetative energy dissipaters, and settling ponds. Include road designs in the transportation plan of the task order.

15. As part of the contract and task order, require prehaul and post haul maintenance on all local roads used for hauling.

Type:	**Design Feature**
Purpose:	**In accordance with Forest Service National Core Design Criteria (2012), aquatic management zones will be used in project planning, analysis, decision making, and implementation to improve water quality.** **To provide sediment filtering ability and/or to provide bank stability on all streamcourses and to minimize impacts on erosive soils.**

16. The designation of filter strips (also known as Aquatic Management Zones) minimizes onsite soil movement from timber harvest activities along streamcourses. These stream reaches will be designated as protected streamcourses. Include locations of protected streamcourses in the individual Task Order Maps, and mark these streamcourses with a protected streamcourse designation.

17. The following are recommendations to protect streamcourses within the proposed tree harvest units in relation to riparian and non-riparian streamcourses. The guidelines for filter strip designations are as follows:

    Riparian streamcourse:

    Severe erosion hazard: 120 feet on each side of streamcourse.

    Moderate erosion hazard: 100 feet on each side of streamcourse.

    Slight erosion hazard: 70 feet on each side of streamcourse.

    Non-riparian streamcourse:

    Severe erosion hazard: 100 feet on each side of streamcourse.

    Moderate erosion hazard: 70 feet on each side of streamcourse.

    Slight erosion hazard: 35 feet on each side of streamcourse.

18. Do not cut any tree contributing to shade on the stream in the primary shade zone (this zone represents any tree providing shade to the perennial during greatest solar inputs, 1000 hrs through 1400 hrs). Retain 50% canopy cover in the primary shade zone. Do not cut any tree that will destabilize the streamcourse bank. Manual cutting and hand dragging of trees is allowed. No mechanical entry in aquatic management zones.

19. Should a perennial steam crossing be needed, the timber sale administrator or the contracting officer representative will contact the Supervisor’s Office watershed staff for pre-planning and field visits.

Type: **Design Feature**

Purpose: **Filter sediment and/or provide bank stability on all drainage courses and to minimize impacts on drainage courses.**

For all ephemeral and intermittent drainages:

20. Establish a 30-foot filter from the channel center on all drainages.
21. Do not cut trees cut that will destabilize the drainage course.
22. Do not operate mechanical equipment within the filter area.
23. Obtain onsite approval for any needed crossing from the timber sale administrator, contracting officer representative, or Supervisor's Office watershed staff. Crossings will have sufficient armoring.
24. Allow handcutting and hand-dragging of trees within the filter if cutting them does not destabilize the drainage course.
25. Allow chain-dragging trees out of the 30-foot filter on dry or frozen soil. The heavy equipment doing the dragging is NOT allowed in the 30-foot filter area.
26. Do not place any slash pile within the filter boundaries.
27. Do not allow construction of landings within the filter.

Type: **Design Feature**

Purpose: **To promote long-term soil productivity.**

28. Manage for a minimum of 5 to 7 tons per acre of boles on ponderosa pine sites.

Type: **Design Feature**

Purpose: **To minimize and mitigate impacts from activities that compact sites and to restore long-term soil productivity and to minimize impacts on .severe erosion soils.**

29. Identify landings and staging areas for heavy equipment and any in-woods processing sites outside of filter strips and meadows. Rehabilitate sites after use by methods such as, but not limited to: 1) ripping to remove compaction; and 2) seeding with certified weed free native seed to 12 pounds per acre; and 3) spreading of slash to disguise the site and provide a mulch for seeds. Use the Santa Fe National Forest Terrestrial Ecosystem Survey to identify species for seed mix.

Type: **Design Feature**

Purpose: **To promote long-term soil productivity.**

30. Because operating during wet or soil saturated conditions is the top condition leading to resource damage, suspend task order unit activities when wet or saturated operating conditions are identified by the timber sale administrator, contracting officer representative, Supervisor's Office watershed staff, the timber sale administrator, contracting officer representative, or Supervisor's Office watershed staff or operators.

31. Manage for all slash in piñon-juniper sites to be spread effectively and sufficiently in order to slow overland flows of water.

Type:	**Design Feature**
Purpose:	**To promote long-term soil productivity. Reduce the alternative action effects and potential for decreasing current watershed function and recovery.**

32. Implement up to 2,500 acres of mechanical treatment per year in those watersheds (Huc12s) with an EDA/ERA existing condition of less than 15%. Also, allow additional mechanical harvest or thinning acreage (more than 2,500 acres) during frozen soil conditions.
33. Implement up to 1,000 acres of mechanical treatment per year in those watersheds (Huc12s—Church Canyon-Jemez River, East Fork Jemez River, Outlet Rio Cebolla, and Outlet San Antonio) with an EDA/ERA existing condition greater than 15%. Also, allow additional mechanical harvest or thinning acreage (greater than 1,000 acres) during frozen soil conditions.

Headcut Treatments

Type:	**Design Feature**
Purpose:	**To minimize loss of soil productivity and limit erosion.**

1. Headcuts accessed by existing roads with surrounding non-erosive soils are candidates for mechanical treatment (placing of materials by machinery). Headcuts not accessed by existing roads or that are on erosive soils can receive mechanical treatment if done when dry or frozen soil conditions exist.
2. Conditions or timing may limit treatments by hand crews.

Type:	**Design Feature**
Purpose:	**To minimize loss of soil productivity and limit erosion. Prevent further loss of soil due to headcut migration.**

3. Mechanical treatments include using a dump truck, backhoe, and a small staging area.
4. Place staging area on the road or immediately adjacent to the road.
5. Use locally available material when feasible.
6. Use hand treatments at those locations without road access or those areas needing less (mechanical) disturbance due to resource concerns (soils, cultural, wildlife).
7. Hand treatments may include mechanical staging of fill material.
8. Prioritize treatment locations with respect to current sediment inputs into perennial streams and those perennial streams that are 303-d listed for sediment and/or turbidity

Type: **Best Management Practices**

Purpose: **Reduce soil detachment and transport.**

1. Repair degraded channel function (headcut) and improve water quality and soil stability.

Instream Habitat Restoration, Bank Stabilization, and Stream Channel Treatments

Type: **Design Features**

Purpose: **Design feature specific to project.**

1. For all activities, use local materials and native plants when available.

Type: **Design Features**

Purpose: **To prevent sediment inputs into the stream; prevent increasing of width-to-depth ratio and entrenchment ratio. To create aquatic habitat.**

2. Bank stabilization treatments may include the following: 1) mechanical actions (i.e. use of a dump truck for staging material and backhoe for placing material); 2) installing or placing post-vanes bank armor, or grade control large woody debris or boulders; 3) key rootwad placement, or 4) gravel or bedload augmentation.
3. Use bank stabilization treatments on those perennial streams needing actions to improve a 303-d listing or those needed for aquatic habitat improvement.

Type: **Design Features**

Purpose: **To prevent sediment inputs into the stream; prevent increasing of width-to-depth ratio and entrenchment ratio. To create aquatic habitat and to protect habitat for Jemez Mountains salamander.**

For all bank stabilization treatments (including removal of failed fish structures):

4. Do not cut Douglas-fir for bank stabilization treatments in critical or occupied habitat for the Jemez Mountains salamander.
5. Use silt fences or waddles, if needed, to stop localized soil disturbance.
6. Plant native riparian vegetation to further stabilize the bank work.
7. Install fencing to protect the bank work.
8. Work will take place during base-flow conditions and dry or frozen soil conditions.
9. When feasible, use manual labor in the placing of post-vane, armor, bed-load additions or other similar structures

Type: **Design Features**

Purpose: **Prevent sediment inputs into the stream; prevent increasing of width-to-depth ratio and entrenchment ratio. Create aquatic habitat. Create wetland habitat.**

10. Stream re-channelization will be used only in stream reaches meeting the qualifying stream channel physical characteristics. The primary technique will be plug and pond.
11. This action may take place on 2 identified locations, one each on San Antonio Creek and the Rio Cebolla, with each reach not to exceed 200-yards of stream course.

For all stream re-channelization:

12. A 401/404 permit from the U.S. Army Corps of Engineers is required.
13. Mechanical equipment may be used and includes the use of dump trucks and backhoes. Use silt fences and/or waddles, if needed, to keep sediment out of streams.
14. Actions will not take place during periods of bankful flow. Actions will take place during periods at or near base-flow.
15. Install fencing around both the old and new stream channels in each of the selected stream reaches.
16. Plant native riparian vegetation for bank stabilization.

Type: **Best Management Practices**

Purpose: **Prevent soil detachment and transport, reduce sedimentation, stabilize streambanks and provide aquatic habitat.**

Reconnect flow to floodplain, create riparian and aquatic habitat, and reduce soil loss and sedimentation.

For all bank stabilization treatments:

1. Design and implement stream channel projects in a manner that increases the potential for success in meeting project objectives and avoids, minimizes, or mitigates adverse effects to soil, water quality, and riparian resources.

For all stream re-channelization activities:

2. Design channels with natural stream pattern and geometry and with stable beds and banks; provide habitat complexity where reconstruction of stream channels is necessary.

Nonnative and Invasive Plants

Type: **Mitigation**

Purpose: **Prevent spread and establishment of nonnative and invasive plants.**

For harvesting operations:

1. Prior to moving off-road equipment onto the sale area, purchaser shall identify the location of the equipment's most recent operation. Purchaser shall not move any off-road equipment that most recently operated in an area infested with one or more invasive species of concern onto the sale area without having cleaned such equipment of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, and having notified the Forest Service.
2. Prior to moving any off-road equipment subject to cleaning requirements, the purchaser will advise the Forest Service of its cleaning measures and make the equipment available for inspection. The Forest Service will have 2 days, excluding weekends and Federal holidays, to inspect the equipment after it has been made available. After satisfactory inspection or after the 2-day period, the purchaser may move the equipment as planned. Equipment will be considered clean when a visual inspection does not disclose seeds, soil, vegetative matter, and other debris that could contain or hold seeds. The purchaser will not be required to disassemble equipment unless so directed by the Forest Service after inspection.
3. If the purchaser desires to clean off-road equipment on National Forest land, such as at the end of a project or prior to moving to, or through an area that is free of invasive species of concern, Purchaser shall obtain prior approval from Contracting Officer as to the location for such cleaning and measures, if any, for controlling impacts.

For road maintenance:

4. Clean and carefully inspect all earth-moving or tree-masticating equipment prior to entry onto forest land to ensure removal of all dirt, plants, and other foreign material that may transport noxious weed seeds.
5. Treatment may be deferred on a particular weed species when a reason is stated

Private Property and Structures

Type: **Mitigation**

Purpose: **Protect flammable structures**

1. Notify landowners in advance of prescribed burning.
2. Protect flammable structures in the project area from fire-related damage by removing fuels, building firelines, burning blacklines, or other methods.

Rangeland Resources

Type: **Mitigation**

Purpose: **Protect range infrastructure. Monitor resource conditions.**

For prescribed burning:

1. Protect fire-sensitive range infrastructure (corrals, pipelines, water storage tanks, water troughs, fences, and cattleguards) from fire damage. Methods may include pre-burn fuel removal, fire containment lines around structures, strategic ignition patterns, or other methods.
2. Fencelines will be used as burn area boundaries when possible.
3. Fire and timber personnel will coordinate with district range staff on prescribed burn operations and harvesting activities at least one year prior to implementation.

For all activities:

4. Existing rangeland monitoring sites will be located prior to treatments. Monitoring sites will not be excluded from treatments; however, sites will not be used for landing areas, skid trails, slash piles, gravel pits or roads.
5. Timber operations will consult with the district range staff to determine pasture use during harvest activities.
6. All fences will be protected from harvesting activities. Temporary cattleguards will be installed if needed. Skid trails, and temporary roads will be laid out so as to avoid cutting fences.
7. All water facilities (earthen dams, trick tanks, storage tanks, pipelines, drinkers, etc.) should not be removed or excluded by harvesting or prescribed burning operations.

Recreation

Type: **Mitigation**

Purpose: **Maintain consistency with Forest Plan in regard to tree cutting in wild segment of the East Fork Jemez River Wild and Scenic River. (p. 2002-4).**

Resource protection on trails within project area.

Minimize impacts on majority of visitors, who use the forest during summer season.

Protect trail amenities.

Avoid mechanical treatments in the Semi-Primitive Non-Motorized ROS setting within wild segment of the East Fork Jemez River Wild and Scenic River.

1. Avoid using trails as skid trails or temporary roads. If a trail, or section of trail, is used as a skid trail or temporary road, include trail clean up and rehabilitation in the contract. This shall include restoring the trail to its original width.
2. Avoid conducting initial entry prescribed burns in the Jemez National Recreation Area (JNRA) during peak recreational season (Memorial Day weekend through Labor Day).
3. Avoid treatment implementation on weekends and during holiday weekends.
4. Avoid siting and construction of gravel pits in the Inventoried Roadless Area, JNRA, and the East Fork Jemez River Wild and Scenic River corridor.

Riparian Area Restoration

Type: **Design Feature**

Purpose: **Design features specific to project. Reduce ungulate use in riparian areas and impacts along streambanks.**

1. Dispersed recreation areas needing treatment will be identified by the district recreation staff and the forest watershed specialist.
2. Close sites by placing soil, rock, and boulders on and around the site. Exclosures may be built to limit access by livestock and people.
3. Best effort will be made to use immediate, locally available material and plants.
4. Gaps between exclosures should be a sufficient length to spread out livestock and wildlife water access use to reduce concentrated stream and streambank impacts. Gaps along the stream between exclosures should be at least double the size of the exclosures.
5. Where vegetation has been severely impacted, planting of riparian shrubs, i.e., willow, and transplanting of sedges may be done within the exclosures.

Road Decommissioning and Rehabilitation Treatments

Type: **Design Feature**

Purpose: **Reduce effects from roads.**

1. Intensity of treatment will depend on what resources are in the area, length of the road, soil conditions, slope of the roads, and resource being damaged.
2. Use the following methods: installing signs, blocking entrances, restoring vegetation, eliminating the road bed, and other methods described in Forest Service Manual 7734.1.
3. Roads causing damage to hydrological resources, cultural resources or threatened endangered, and sensitive species habitat are a priority for decommissioning.

Type: **Design Feature**

Purpose: **To minimize soil erosion and minimize spread of noxious weeds.**

For site rehabilitation on stream-crossing projects where ground disturbance occurs:

4. Seed with native, certified weed-free seed mix. Use the Santa Fe National Forest Terrestrial Ecosystem Survey to identify species to be seeded at individual sites. Where feasible, spread slash across the disturbed area to create microclimates and protect from grazing ungulates.

Type: **Design Feature**

Purpose: **To minimize soil erosion and minimize spread of noxious weeds.**

5. Install silt fences and/or waddles downstream from ground-disturbing activities in stream channels to minimize sediment delivery into the stream during construction. Remove silt fences when revegetation is completed.

Type: **Design Feature**

Purpose: **To comply with state and federal water quality standards by minimizing sediment delivery to drainages and to create microclimate for regeneration of grass and forb communities and minimize spread of noxious weeds.**

6. Use hydromulch, mulch, erosion mats, slash, or other methods to protect newly disturbed soils (e.g.) at stream-crossing sites as needed and where feasible. Use only certified weed-free straw.

Type: **Design Feature**

Purpose: **To comply with state and federal water quality standards by minimizing soil erosion through the stabilizing influence of vegetation ground cover. Minimize noxious weed spread.**

Site rehabilitation at stream crossing sites:

7. Use one of the following revegetation methods for site rehabilitation such as, but not limited to: 1) Store sod removed from the initial ground disturbance and replace the sod from the top of the bank on the disturbed site; 2) Seed with a native seed mix (see above) 3) Protect site with slash spread across the disturbed area to create microclimates and protect from grazing ungulates. Limit slash placement to the upper 2/3 of the streambank to limit downstream transport of woody material; 4) Fence out ungulates until the site has reestablished); 5) use mycorhizal inoculum on severely disturbed sites where no topsoil is left; and 6) install erosion mats.

Type: **Design Feature**

Purpose: **To minimize disturbance in drainage systems and minimize sediment production within channel.**

8. Do not borrow road fill or embankment materials from the stream channel or meadow surface on road maintenance or stream crossing projects. Compact (compress) the fill dirt.

Type: **Design Feature**

Purpose: **To minimize sediment delivery into drainage and to minimize disturbance in drainage systems and minimize sediment production within channel.**

9. Relocate roads out of filter strips to an upland location where feasible. If this is not feasible, use riprap or velocity checks to stabilize or disperse water outfall on road maintenance projects when roads are located within filter strips.

Type: **Design Features**

Purpose: **To comply with state and federal water quality standards by minimizing soil erosion through stabilization of ground cover. Minimize noxious weed spread.**

10. At stream crossing sites, restore riparian-dependent grasses by 1) seeding native species, and 2) planting plugs of rushes and sedges to improve success of regeneration efforts. Fence with ungulate proof fencing until plants are established.

Type: **Best Management Practice**

Purpose: **To comply with Clean Water Act provisions and to reduce channel sedimentation.**

Roads not stabilized or maintained contribute to excessive soil loss and degraded channel function.

1. Coordinate stream crossing rehabilitation (channel, shoreline, lake, pond, and wetland activities with appropriate state and federal agencies. Incorporate Clean Water Act 404 permit requirements and other federal, state, and local permits or requirements into the project design and plan.
2. Road decommissioning includes a variety of treatments to block the road, revegetate the road surface, restore surface drainage, remove crossing structures and fills, mitigate road surface compaction, re-establish drainage-ways, remove unstable road embankments, and recontour the surface to restore natural slopes. One or more treatments are applied to decommission the road depending on resource objectives and cost.
3. Roads not needed for access for long periods (more than 1 year) may be put into “storage” to reduce maintenance costs. Level 1 roads receive basic custodial maintenance focusing on maintaining drainage facilities and runoff patterns to avoid or minimize damage to adjacent resources and to perpetuate the road for future use. The integrity of the roadway is retained to the extent practicable and measures are implemented to reduce sediment delivery from the road surface and fills and reduce the risk of crossing failure and stream diversion.

Road Maintenance Treatments

Type: **Design Features**

Purpose: **Reduce channel sedimentation**

1. Mechanized equipment would not be used within clearly defined drainages (perennial, intermittent, or ephemeral) or riparian areas.
2. Restrict ground-based equipment from operating when soils are saturated or approaching saturation.
3. Roads will receive maintenance as needed throughout the life of the project or duration of the contract.

Scenery

Type: **Design Features**

Purpose: **To achieve a level of scenic integrity consistent with direction established in the Forest Plan**

All activities within the viewshed of Sensitivity Level 1 travelways and use-areas (the most sensitive area) as shown on Sensitivity map in the scenery specialist report.

1. The viewsheds, or areas visible, from the Sensitivity Level 1 areas will be managed to meet or exceed a scenic integrity level of High within 5 years after implementation: the landscape appears natural; management activities are present but not evident.
2. A landscape architect or forest recreation specialist will be involved with the initial unit layout strategy. The extent of veiwsheds from Sensitivity Level 1 areas will be confirmed in the field. Portions of the project area that are representative of the various treatments proposed will be used to convey specific resource instructions and overall marking strategies.
3. For prescribed fire, use existing barriers (roads) and natural barriers as control lines whenever possible.
4. Protect large mature trees where possible, particularly those with a diameter over 26 inches and with yellow bark features.

All activities within Management Area F (East Fork Jemez Wild and Scenic River (WSR)):

5. Existing groupings of gamble oak and other understory vegetation will be retained and encouraged to promote visual diversity.
6. Seeding mixtures will contain a high percentage of berry-producing shrubs, colorful plants, and wildflowers, as prescribed in the Jemez WSR Plan.

Type: **Mitigation for activities within Management Area F**

Purpose: **Consistency with management direction in the forest plan.**

1. In the East Fork Jemez WSR, any tree harvest decks and landings will be located outside of the immediate foreground zone (300 feet) of the river, roads, trails, and recreation areas. Landings will be restored to original or characteristic contours and re-vegetate within one year of project completion.
2. Within the East Fork Jemez WSR, dispose of activity-generated slash in the immediate foreground zone (300 feet) of the river, trail and recreation areas within one year of project completion, with the exception of a maximum of five logs per acre with a minimum 12-inch diameter and 15-foot length for wildlife.

Type: **Mitigation**

Purpose: **Reduce visibility of treatments**

Road skid trail and landing construction activities visible from Sensitivity Level 1 travelways and use-areas:

3. Rehabilitate all equipment staging areas, log landings, skid trails, temporary roads and fire lines at the end of the project so as to not be visually evident from Sensitivity Level 1 areas immediately following implementation. Rehabilitation will include returning the ground to natural contours, implementing decompaction and erosion control measures as needed, pulling slash and rocks across fire lines, disguising entrances and covering bare soil with slash, chips, needles or cut brush as necessary. Restore proper drainage and reseed as needed with native species. Reseed and mulch landings according to applicable BMPs (see soil and water resources specialist report) as soon as possible to speed recovery. If trails are used, rehabilitate trails to original width, condition, and designated class level.
4. Align temporary roads to use topography and vegetation where possible to help screen them from vista points and Sensitivity Level 1 travelways.
5. Minimize the distance you can see down temporary roads and skid trails from intersections with Sensitivity Level 1 roads and trails. Efforts should be made to have them intersect at a right angle, then curve the temporary road or skid trail soon after the junction to limit the distance seen down the temprary road.
6. Avoid using machinery within the dripline of leave-trees to prevent scarring by equipment.

Type: **Design Features**

Purpose: **Reduce visibility of treatments**

Mechanical treatments visible from Sensitivity Level 1 travelways and use-areas:

7. All created openings will be in scale with the surrounding landscape features. Openings will be strategically located to maintain or create distant views of scenery.
8. Mechanical treatments will be designed to enhance the visual diversity within the landscape by providing for a variety of tree sizes, spacing, and densities.

Type: **Mitigations for mechanical treatments visible from Sensitivity Level 1 travelways and use-areas**

Purpose: **Reduce impacts on scenic integrity**

9. The size of created openings visible within foreground distances (½ mile) from the Sensitivity Level 1 areas will range up to 4 acres. Openings in middleground distances (½ mile to 4 miles) will range up to 10 acres.
10. Maintain free-form shapes and edges that reflect the natural, open-space patterns of the desired landscape character. Create openings in the canopy that vary in size and shape while leaving groups or clumps of uneven-aged trees. The shape will relate to the topography and will flow with the contours, following natural lines of the slopes, mesas, ridges, drainages and rock outcrops.
11. Stump heights shall be cut as low as possible, with the cut angled away from the viewer. Flush cut stumps within 4 inches of the uphill side of the stump where possible.
12. Avoid unnatural-looking (straight) lines by undulating edges of the treatment areas horizontally and establishing a diverse height of leave trees.
13. Feather the edges of mechanical treatments to blend into the surrounding landscape. Where the treatment unit is adjacent to denser forest, the percent of thinning within the transition zone is progressively reduced toward the denser edges of the unit. Similarly, where the treatment unit interfaces with an opening (including meadows and other natural openings) the transition zone is progressively increased toward the open edges of the unit.
14. Mark trees that are to be removed on the backs of trunks, away from the primary viewing point, so marks do not detract from the landscape character.
15. If machine piling is used in areas visible from Sensitivity Level 1 areas, then special brush rakes or grapples are recommended to minimize damage to existing groundcovers.

Type: **Mitigation**

Purpose: **Reduce visibility of treatments**

16. Slash treatments readily visible from Sensitivity Level 1 travelways and use-areas:
    Pile and burn, or masticate woody debris visible from Sensitivity Level 1 use-areas as soon as possible after project implementation. No residual material should be left after pile burning. Excess slash to be burned will be piled in irregularly-spaced intervals. Do not build piles in straight lines. Care must be taken to create irregularly shaped burn piles so as to not leave a circular burn footprint.
    Scatter burned slash on control lines to reduce the color contrast of the exposed soil.

Type: **Design Feature**

Purpose: **Reduce visibility of fences seen from Sensitivity Level 1 travelways and use-areas.**

17. Design fences that complement the natural and cultural setting by either blending visually into the landscape or reflecting the cultural history of the area. Dark colored metal posts, split-rail, or buck and pole fencing are recommended in areas visible from of Sensitivity Level 1 travelways and use areas.

Type: **Mitigation**

Purpose: **Reduce visibility of fences seen from Sensitivity Level 1 travelways and use-areas**

18. In areas visible from Sensitivity Level 1 travelways and use-areas, use dark colored steel posts for elk-exclosure fences (8feet tall).

Type: **Design Feature**

Purpose: **Reduce visibility of meadow treatments seen from Sensitivity Level 1 travelways and use-areas:**

19. Areas where heavy machinery will be used will be restored to a natural-appearing state. Re-grade and re-vegetate around earthen dams and constructed pools and channels to simulate the natural terrain of the area and blend into existing contours.

Type: **Mitigation**

Purpose: **Reduce visibility of meadow treatments seen from Sensitivity Level 1 travelways and use-areas.**

20. Avoid machine piling in meadow areas.
21. Construct concrete barriers, retaining walls, and/or highly visible headwalls and endwalls of box culverts with color and/or texture qualities that blend into the existing landscape.
22. Use native plants characteristic to the area to screen tanks and drinkers from roads and trails.
23. If slash is not removed in meadow treatment areas, then the preferred treatment is to lop and scatter to 24-inches high.

Seep and Spring Treatments

Type: **Design Feature**

Purpose: **Limit ungulate access to seep and spring areas and to retain large trees.**

24. Hand cut and remove conifers less than 16-inches diameter that are within 100 feet of identified seeps or springs.
25. If possible, pile slash along the 100-ft boundary to limit ungulate access.
26. Large trees may be cut and removed or cut and left in place.
27. Do not cut trees that will lead to destabilization of the spring, seep, or channel. Cutting or falling of conifers is allowed. Drag trees from site only when soil is frozen. Do not drag trees if the drag path crosses or destabilizes a seep, spring, channel or other feature.

Type:	**Design Feature**
Purpose:	**To comply with state and federal water quality standards by minimizing soil erosion through stabilization of ground cover. Minimize noxious weed spread.**

28. Obtain Supervisor Office approval and selection of an onsite spring and seep protection specialist(s). This specialist will be onsite during ground-disturbing activities.

Type:	**Design Feature**
Purpose:	**To protect the Jemez Mountains salamander and its habitat.**

29. Do not treat springs or seeps found in wet mixed conifer in Jemez Mountains Salamander critical habitat.

Type:	**Design Feature**
Purpose:	**Improve hydrologic function of seeps and springs.**

30. Cutting and/or removal of conifers is allowed if spring or seep has an existing non-conifer woody or riparian component. If no riparian component exists, remove trees less than 16-inches diameter leaving only those that will improve hydrologic function. If site has all smaller age-classes, leave an appropriate number of trees that will improve hydrologic function.
31. Remove livestock grazing access at spring or seep complexes with fencing. Use material cut onsite or pile (jackstraw) cut material

Type:	**Design Feature**
Purpose:	**Sufficient quantities of water needed for spring and wetland function will have equal priority to water needed for livestock.**

32. If a spring or seep with a water trough or other water structure is being used by livestock, relocate the water structure away from spring or seep complex.

Type:	**Design Feature**
Purpose:	**Improve hydrologic function of seeps and springs.**

33. Slash and cut trees can be used (placed) to improve spring or seep hydrologic function. Use manual methods to drag excess fuels offsite, and place in burn piles not exceeding 6-feet diameter and 5-feet high.

Type:	**Design Feature**
Purpose:	**Improve success of regeneration efforts.**

34. At spring restoration sites, restore riparian-dependent plants by seeding native species and/or planting plugs or cuttings of native plants (trees, shrubs, grasses, forbs, etc.).

Type: **Best Management Practices**

Purpose: **Restoring spring and seep habitat will improve function and water quality and quantity.**

1. Consider how existing water quality and quantity and habitat conditions at the project site have been affected by past habitat alterations, hydrologic modification, and riparian area changes in the watershed.

Silviculture Treatments

Type: **Design Feature**

Purpose: **To meet forest plan direction for vegetation management.**

Uneven-aged management using selective cutting in ponderosa pine:

1. A target basal area 54 -84 within groups of trees or about 20-80 overall (including interspaces)
2. Groups are 0.1 to 4 acres, averaging .5 acres, and generally consist of 2 to 14 dominant and co-dominant trees per .1 acre.
3. Approximately 10% of the area would be in openings (grasses and forbs), and approximately another 10% in regeneration (seedlings and saplings).
4. Crown spacing between groups of trees (interspace) would vary depending on treatment intensity. Interspaces would be 30-60 feet between groups of trees. A total of 30-60% of the area would not be treed because of openings and interspaces. There would be more openings where the site index is lower.
5. Openings are up to 4 acres in size and placed in VSS 3 and 4 stands, or stands with heavy mistletoe, or around existing openings.
6. Size classes would be balanced as much as possible.
7. Species composition would be primarily ponderosa pine with Gambel oak and juniper. Douglas-fir and limber pine are incidental.
8. Leave 5-7 tons per acre of woody debris and 2 snags per acre.
9. Prescribe burn every 5-10 years.

Type: **Design Feature**

Purpose: **To move stands toward desired condition.**

Stand improvement thinning and burning in ponderosa pine:

10. Thin, primarily from below, to improve growth and vigor.
11. Thin tree groups to free-to-grow conditions to allow for rapid growth and development.
12. Establish interspaces between remaining tree groups.

13. Establish crown spacing between groups that would vary from 30 to 60 feet depending on treatment intensity.
14. The priority for establishing openings would be in currently non-stocked areas and in areas that have moderate to severe dwarf mistletoe infection.
15. We would use this type of thinning in young, even-aged stands such as plantations, stands with light to moderate dwarf mistletoe, along some prescribed burn fire lines, and in remote and/or steep stands.
16. Prescribe burn to treat slash.

Type:	**Mitigation**
Purpose:	**To control bark beetles.**

In ponderosa pine:

1. Slash greater than 3-inches in diameter that is created between January and June must be removed, burned, cut to short lengths, chipped, or otherwise treated, within 21 days. Material cut in winter may be left on site until March 15. These measures may be modified by a silviculturist based on weather and specific stand conditions.

Type:	**Design Feature**
Purpose:	**To meet forest plan direction.**

Uneven-aged management using selective cutting in dry mixed conifer:

17. Target basal area of 72-120 within groups, or about 30-100 overall (including interspaces).
18. Groups are .1 to 2.5 acres, averaging less than 1 acre. 10% of the area would be in openings, another 10% in regeneration. A total of 10-50% of the area would not be treed because of openings and interspaces. Interspaces are 30-60 feet between groups of trees.
19. Size classes would be balanced as much as possible.
20. Species composition is a mix of ponderosa pine, Douglas-fir, limber pine, white fir, and aspen.
21. Leave aspen as individual trees or small groups.
22. Leave 5-15 tons per acre of down logs greater than 12-inches diameter and 3 snags per acre, on average.
23. Prescribe burn every 7-12 years.

Type:	**Design Feature**
Purpose:	**To move toward desired condition.**

Stand improvement thinning and burning in dry and wet mixed conifer:

Dry mixed conifer:

24. Treatments are similar to those described for ponderosa pine stand improvement.

25. Create groups and openings, but smaller than in ponderosa pine. Higher stand density than in ponderosa pine.
26. Prescribe burn to reduce slash.

Wet mixed conifer:

27. Individual tree selection, light thinning if needed to reduce fire hazard. Burn only if fire backs into stand from an adjacent burn.
28. Possible reasons for treatment are: proximity to endangered species habitat, WUI, springs, insects, disease, or other special need areas, or as small inclusions of wet mixed conifer within other cover types.
29. Treatments would be uneven aged, individual tree selection across size classes with small (0.1 acre) openings for regeneration.
30. Balance successional stages. If early succession (aspen) is lacking (less than 20% of the cover type), cut patches to stimulate regeneration.

Type:	**Design Feature**
Purpose:	**To move toward desired condition, create diversity across the landscape.**

Treatments to maintain or increase aspen cover type:

31. To maintain acres in aspen, cut invading conifers in stands. Cut trees may be removed.
32. To create new acres of aspen, stimulate regeneration by cutting conifers where they have overtopped aspen stands.
33. Focus on stimulating new aspen stands on the north and west portions of the project area, because the eastern portion is near the Las Conchas burn which has lots of new aspen.
34. Create patches of 5-40 acres, spread across the landscape, to provide vegetative diversity and fire breaks.
35. Put patches in existing conifer stands of VSS 2, 3 and 4. Focus patches on places where conifers have mistletoe, budworm, high bark beetle risk, etc.
36. Leave conifers larger than 24-inches diameter

Type:	**Design Feature**
Purpose:	**Maintain and enhance cover type.**

Treatments in piñon-juniper:

37. Desired residual tree densities are between 50-200 trees per acre.
38. Leave a range of tree sizes.
39. Prioritize areas for treatment to reduce erosion, protect heritage sites, or to increase habitat for songbirds.
40. Firewood may be gathered where roads allow.

41. Scatter slash to provide ground cover or pile and burn.
42. No broadcast burning.

Type:	**Design Feature**
Purpose:	**Protect Mexican spotted owls.**

Treatments in Mexican spotted owl protected activity centers:

43. No thinning or mechanical treatments in nest areas.
44. Thin if owl habitat can be improved or to reduce fire risk. This would move the stands toward having larger trees and a multi-storied canopy.
45. Thin primarily small trees and create gaps in the overstory using group or individual tree selection.
46. Leave trees larger than 24-inches diameter.
47. Burn slash from treatments.

Type:	**Design Feature**
Purpose:	**Maintain and enhance stands with old-growth characteristics for forest diversity and wildlife habitat.**

Old growth treatments:

48. Prioritize stands within or adjacent to Mexican spotted owl protected activity centers, goshawk post-fledging family areas, Jemez Mountains salamander locations, and visually-sensitive areas for old growth management.
49. Select stands classified as VSS 5 and 6 for inclusion in the old growth allocation.
50. Thin primarily small trees and create gaps in the overstory with group or individual tree selection.
51. Leave trees larger than 24-inches diameter.
52. Burn slash from mechanical treatments, but avoid reducing the amount of large woody debris.

Type:	**Design Feature**
Purpose:	**Mitigate the effects of roads**

Alternative 3:

53. Design features are the same as the proposed action for all vegetation types, but no temporary roads would be built. Fewer acres would be treated.

Purpose: **Mitigate the effects of smoke**

Alternative 4:

54. Design features are the same as the proposed action for all vegetation types, except that areas that are mechanically treated would not be burned. The total area treated is the same as the proposed action. Slash from thinning and other treatments would not be burned. Slash would be chipped or ground up (masticated) or in some areas, left on site (lopped and scattered). Prescribed burning would occur in those areas described under the proposed action as prescribed burn only.

Soil and Watershed Health and Function

Type: **Design Feature**

Purpose: **Conduct operations that reduce erosion, compaction, soil detachment, transport, and rutting.**

1. Cumulative and proposed actions and their combined proposed soil impacts exceeding 15% of the HUC12 will require additional design criteria as listed in the watershed specialist's report.

Type: **Design Feature**

Purpose: **Conduct operations that reduce erosion, compaction, soil detachment, transport, and rutting. These actions will produce less detached sediment and less sediment delivery into all drainage types, thus improving water quality and soil productivity.**

2. Winter logging on frozen soil is preferred to mitigate surface disturbance and accelerate vegetative recovery.
3. Conduct logging operations using the least surface-disturbing equipment. The preferred equipment is a harvester-forwarder with an articulating boom and a harvester head that is used on designed skid trails.
4. Attempt to make no more than 3 passes on a skid trail as research shows compaction greatly increases after a third pass.
5. Do not operate in wet or saturated soil conditions.

For all treatments on Mollisol soils (TEU units 156, 630, 631, 641, 642, and 652):

6. Do not exceed a 5 percent increase per year in existing bare soil conditions.
7. Do not locate landings within these units.
8. Minimize construction of new skid trails, and use existing trails, routes, and roads instead.
9. Roads and skid trails used in treatment polygons within the Mollisol soil units will be hydrologically stabilized within 24 hours of the unit or polygon closeout. This will be verified

by the Supervisor's Office watershed staff, timber sale administrator, contracting officer representative, or personnel approved by the watershed staff.

Type:	**Design Feature**
Purpose:	**Low soil severity burn on Mollisol soils will reduce vegetative recovery times and improve overland flow or infiltration, and reduce soil detachment and transport.**

10. Grinding or chipping operations on the Mollisol soil units will not exceed a 2-inch or one-layer thickness of chip-grind material.

Type:	**Best Management Practice**
Purpose:	**Maintain and improve watershed function and soil productivity.**

1. Avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources by implementing measures to control surface erosion, gully formation, mass slope failure, and resulting sediment movement before, during, and after mechanical vegetation treatments.

Type:	**Design Feature**
Purpose:	**Monitoring**

1. For vegetation and prescribed fire treatments, implement the Forest Soil Disturbance Monitoring Protocol (FSDMP) and the Soil Disturbance Field Guide. Pre-disturbance data (baseline data) will represent all ecotypes and treatments and further provide a seamless transition into BMP monitoring. Implement proper functioning condition (PFC) monitoring on the streams within the project area. The pre-treatment PFC monitoring will provide a baseline to determine post-treatment effectiveness in the project area streams and associated riparian corridors.
2. The timber sale administrator will monitor the implementation of BMP's during timber harvesting activities. Forest Watershed Specialists will employ those BMPs necessary to the riparian, stream, springs and seeps actions.
3. The timber sale administrator will verify that the timber sale purchaser has implemented all erosion control measures prior to the closure of the timber sale. Primary responsibility will be that of the timber sale administrator and the Forest Watershed staff.
4. The district fire management officers will verify that all BMPs associated with all burning activities have been implemented and monitored.
5. Within the first 5 years after timber sale closure, BMP's are evaluated for effectiveness. Monitoring will concentrate on such items as erosion control measures for skid trails, log landing or decking areas, road maintenance, road obliteration, and burned areas. Conduct a soil condition and disturbance evaluation within treatment units, focusing on vegetative ground cover, coarse woody debris, soils erosion, soil compaction, and soil displacement.
6. Documented information from monitoring is used to adjust BMPs as necessary, to improve implementation and effectiveness of BMPs. This information will be made available to the

New Mexico Environmental Department for review as specified in the intergovernmental agreement.

Temporary Road Construction and/or Opening Existing Closed Roads

Type: **Design Feature**

Purpose: **Reduce impacts from temporary roads and other road work.**

1. Temporary roads will be of the lowest design specification possible while providing adequate access for product removal.
2. For opening existing closed roads, use design features for road maintenance treatments.
3. Temporary roads will receive maintenance as needed throughout the life of the project or duration of the contract.
4. Existing closed roads will receive maintenance as needed throughout the life of the project or duration of the contract. Close these roads after use.

Wildlife Habitat Treatments

Type: **Design Feature**

Purpose: **Conservation measures to avoid or minimize effects on species and habitat.**

Mexican Spotted Owl:

1. Adhere to the Forest Plan, as amended, applicable to proposed activities in Mexican spotted owl habitat (USFS 1987b, Appendix D, pp.1-6).
   All protected activity centers (PACs) within the project areas would be monitored. A monitoring strategy would look at how the untreated sites and treated sites respond to project activities. The Forest service would track and report results of project level surveys to aid in identifying owl site occupancy at the PACs for the project. Owl site occupancy would aid in determining reproductive success annually. Implementation would not occur in more than half of the sites every year (p. 32) BA 20130718 version.

Type: **Design Feature**

Purpose: **Conservation measures to avoid or minimize effects on species and habitat.**

2. Monitor the effects to peregrine through occupancy surveys during the breeding season.

Type: **Design Feature**

Purpose: **Conservation measures to avoid, improve, or minimize effects on species and habitat.**

Jemez Mountains salamander:

Occupied Stands:

3. Remove ladder fuels from below canopy in the following occupied stands:

    03100330811220
    03100330840111
    03100330840112
    03100331720510

4. Remove all trees less than 20-feet tall.
5. Limb trees up to six feet from ground level.
6. Pile cut trees and limbs by hand.
7. Avoid building or making piles on top of existing large logs.
8. Burn piles before broadcast burning.
9. Prescribe burn in each occupied stand when the surrounding area is broadcast burned.
10. Broadcast burn and burn piles outside monsoon season.
11. Do not ignite prescribed fire in occupied stands; let fire back into the stands from surrounding areas.

Proposed Critical Habitat:

12. Implement meadow treatments as described in the proposed action.
13. Implement cultural resource protection treatments as described in the proposed action.
14. Treat seeps and springs at the upper end of the basal area range based on vegetation type in ponderosa pine and dry mixed conifer. Treatment would not occur in wet mixed conifer.
15. Keep aspen treatments smaller than 10 acres in proposed critical habitat. Generate only enough slash to burn at low to moderate fire intensities to achieve desired results in aspen stands. Leave about 5-7 tons per acre. Excess wood would be removed to prevent a hot fire from damaging the soil.
16. Implement riparian treatments as described in the proposed action.
17. Do not build temporary roads in critical habitat.
18. No new ground disturbance in potential road decommissioning sites.
19. In ponderosa pine, leave a residual stand with a basal area of 60 to 80.
20. In dry mixed conifer, leave a residual stand with a basal area of 80 to 100.
21. Operate heavy equipment on dry or frozen soil.

Type: **Design Feature**

Purpose: **Conservation measures to avoid, improve, or minimize effects on species and habitat.**

For all treatments to screen water sources from human disturbance:

22. Plant vegetation at existing developed water sources near roads or in open (visible) areas throughout the project area.
23. Use hand or mechanical methods for planting.

For all treatments to increase water sources for wildlife:

24. Water sources may include trick tanks, earthen tanks, drinkers, and other types of developed water sources.
25. Earthen dams would not be placed in stream channels.
26. Screen water sources where necessary using design features listed above.
27. Provide ramps in water tanks, as necessary, to allow small animals to escape.

For all treatments to create snags:

28. Work would be done throughout project area in stands lacking large diameter (greater than 16 inches) snags or that do not meet forest plan standards.
29. Create snags by girdling trees or other means.

Type: **Mitigation**

Purpose: **Conservation measures to avoid, improve, or minimize effects on species and habitat.**

1. Around active elk wallows and seeps, preferentially select groups of understory trees to provide desired screening.
2. All work within the channel of Rio Grande Cutthroat Trout (RGCT) occupied streams will be avoided from March 1 to July 15th to minimize effects to spawning fish (p.46). BA 20130718 version
3. In-stream and riparian restoration activities will take place after RGCT spawning during base-flow conditions, and on dry or frozen riparian soil conditions where possible(p.46). BA 20130718 version.

Jemez Mountains salamander:

Upon refinement of the salamander habitat relationship, Santa Fe National Forest would utilize the findings to focus survey efforts and apply treatment minimization measures to occupied site based on site conditions. The intent is to maintain higher canopy cover to maintain shade and minimize ground disturbance while protecting occupied stands from the potential adverse effects from prescribed fire. JMS habitat elements will be monitored before and after treatment implementation through fire effects monitoring plots. The Forest is currently collecting this information using the fire ecology crew at Bandelier National Park Service. These data collection efforts can be used to further our knowledge of the species habitat in the species range.

4. The Forest will cooperate with the U.S. Fish and Wildlife Service to develop an occupancy model for Jemez Mountains salamander.
5. The Forest is working with Rocky Mountain Research Station, Fire Sciences Laboratory on a project designed to look at prescribed fire burn intensities near archaeological sites and its influence on salamander habitat.

Type:	**Conservation Measure**
Purpose:	**Conservation measures to avoid, improve, or minimize effects on species and habitat.**

Where consistent with overall landscape objectives, avoid vegetation disturbance of higher elevation migratory bird habitats during the peak breeding season: May 15 through July 31 (estimated peak bird breeding season at higher elevations in this project area).

Appendix B. List of Projects for Assessing Cumulative Effects

Project Name	General Location	Description
San Juan Prescribed Burn	Northern San Juan Mesa	Prescribed fire (7,306 acres)
Thompson Ridge Prescribed Burn	Around Thompson Ridge community	Prescribed fire (1,161 acres)
Stable Prescribed Burn	On Stable, Holiday, and Schoolhouse Mesas	Prescribed fire (6,200 acres)
San Diego Prescribed Burn	Gilman and Peggy Mesa area	Prescribed fire (14,521 acres)
San Antonio Well	San Antonio Canyon	Water well re-drill
Cebolla Riparian Fence	East of FR376, along Upper Rio Cebolla	Buck and pole fence construction
Virgin Mesa Pipeline	Virgin Mesa	Pipeline repair project
Lake Fork Pipeline	Lake Fork Mesa	Pipeline repair project
Cebolla Cross Fences	Upper Rio Cebolla	Fence construction
Las Conchas Meadow Restoration	Las Conchas picnic area vicinity	Small area – cut edges of meadow
Cat Mesa Tank Cleanout	Located on Cat Mesa	Tank is a small area, already disturbed
Vallecitos Area Thinning	Around Sierra Los Pinos community	Thinning (~800 acres)
Chaparral Thinning and Burning	West of Rio Guadalupe along district boundary	Project footprint is 20,619 acres
East Fork Trailhead (CFRP) Thinning	Trailhead is along NM State HWY 4	Tree thinning outside and inside of developed trailhead area (2.5 acres)
Redondo Campground Thinning	Campground is along NM State HWY 4	Thinning (125 acres)
Jemez Falls Campground Thinning	Campground is along NM State HWY 4	Thinning (210 acres)
Paliza Campground Thinning	Campground along FR 10	Thinning (106 acres)
Thompson Ridge Mastication and Thinning	Around Thompson Ridge community	Mechanical thinning (233 acres)
Virgin Mesa Thinning	East side of Virgin Mesa above Jemez Springs	Thinning (317 acres)
Monument Canyon Mastication	Research section on San Juan Mesa	Mechanical thinning (~230 acres)
Area Closures	FR376 corridor, San Diego Canyon urban interface, East Fork of the Jemez River	Primarily to restrict dispersed overnight camping
San Antonio Hot Springs Parking Lot	Hot Springs along FR 376 north	Constructed eight vehicle parking area
New Bridge across San Antonio Creek	San Antonio Creek at San Antonio Hot Springs	Replaced deteriorated vehicle bridge with pedestrian bridge for trail crossing
Bridges along East Fork of the Jemez River	Bridges associated with Trail 137	Installation of nine new bridges along established hiking trail

Project Name	General Location	Description
Spence Hot Springs Parking Lot	On NM State HWY 4	Constructed seven vehicle parking area
Respect the Rio	Rio Guadalupe corridor	Restoration and education program focused on water quality
Rebuilt Campgrounds at San Antonio and Paliza	San Antonio CG located on NM State HWY 126; Paliza CG located on FR 10, about two miles north of Ponderosa	Renovated (rebuilt campgrounds)
Paving of NM State HWY 126	Fenton Lake to the Rio de las Vacas	Paving of state highway for approximately 10 miles, section was not previously paved
East Fork Trailhead Parking Area	Trailhead along NM State HWY 4	Constructed 28 vehicle parking area
Oat Pony and Hay Canyon Thinning/Meadow Restoration	Canyons along Rio Cebolla	Thinning (314 acres in project area – meadows were open already, smaller actual area of thinning)
Maintenance of Earthen/Trick Tanks	Throughout the analysis area	Tank is a small area, already disturbed
Redondo and San Antonio Exclosures	Along Redondo and San Antonio Creeks	Linear fences
Meadow Thinning in Peralta	Peralta Canyon	Small area – cut edges of meadows in 20 acre project area
Mistletoe Thinning	Jemez Pueblo land on Borrego Mesa	Thinned 60 acres on the Pueblo land within the SWJ boundary
Banco Bonito Thinning and Prescribed Burn	SW corner of the Valles Caldera NP	Thinning and prescribed burning (352 acres)
FR 10 and 376 Maintenance	Length of FR10 and southern FR 376	Routine road maintenance in the existing road prism within previously maintained surfaces, ditches, culverts, etc.
Pumice Mining	El Cajete Mine, El Cajete Expansion (future), Utility Block Mine and Cerro del Pino Rehabilitations, Boone-Duran 2010 (future), South Pit Rehabilitation, South Pit Expansion (future)	The pumice mines currently cover 83 acres. The proposed expansions will include 122 acres. There have been 22 acres rehabilitated.