United States Department of Agriculture

South Sacramento Restoration Project

Draft Environmental Impact Statement

Forest Service   Lincoln National Forest   Sacramento Ranger District   February 2019

South Sacramento Restoration Project Draft Environmental Impact Statement Otero County, New Mexico

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Abstract: The Lincoln National Forest proposes to conduct restoration activities on the Sacramento Ranger District to address landscape-scale forest health issues, hazardous fuels, and declining wildlife habitat quality. The project is being developed under Section 602 of the Healthy Forest Restoration Act of 2003, also known as the Farm Bill authority. The 2014 Farm Bill provides opportunities to identify priority areas for treatment due to threats from forest insects and disease. Alternative 1, proposes no action; there would be no changes in current management. Alternative 2, the Proposed Action, would conduct restoration activities on approximately 140,000 acres in the southern Sacramento Mountains over the next 10 to 20 years to meet initial project objectives, with additional maintenance treatments beyond 20 years. Restoration activities would occur in all ecosystems in the area, including mixed conifer, ponderosa pine, pinyon-juniper, riparian areas, meadows, and aspen habitat types. Restoration activities are based upon a restoration framework that provides management guidelines in frequent-fire forests; activities would focus on thinning and burning treatments to improve forest health and resiliency. The proposed action includes a project-specific amendment to the Lincoln National Forest Land and Resource Management Plan (Forest Plan). This amendment would authorize the use of restoration strategies in places and under conditions that were not foreseen when the current Forest Plan standards and guidelines were established in 1986.

This project is subject to the Predecisional Administrative Review Process (Objection Process) pursuant to 36 CFR 218, subparts A and B. The draft environmental impact statement is available online at <https://www.fs.usda.gov/project/?project=51146>. This document is also available for review at the Lincoln National Forest Supervisor’s Office, 3463 Las Palomas Road, Alamogordo, New Mexico, 88310. Please see the cover letter for information on how and where to submit a comment for the draft environmental impact statement.

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Executive Summary

The Lincoln National Forest, in cooperation with the U.S. Fish and Wildlife Service and New Mexico Department of Game and Fish, is developing the South Sacramento Restoration Project to address landscape-scale forest health issues, hazardous fuels, and declining wildlife habitat quality on 140,000 acres of the Sacramento Ranger District. Forested landscapes in the southwestern United States have become increasingly susceptible to large-scale, high-severity wildfires and insect and disease outbreaks. These landscapes are also increasingly prone to altered plant and animal habitats, leading to reduced biodiversity, ecological function, resilience, and sustainability. Current land management goals for Southwest forests include restoring the landscape toward ecosystem functionality and resilience under a changing climate. Restoration is the process of assisting the recovery of degraded ecosystems. The project is being developed under Section 602 of the Healthy Forest Restoration Act of 2003, as amended by the 2014 Farm Bill. The 2014 Farm Bill provides opportunities to identify priority projects that reduce the risk or extent of, or increase the resilience to, insect or disease infestation. The South Sacramento Restoration Project area falls within the area designated as part of an insect and disease treatment program according to Section 602 requirements.

The South Sacramento Restoration Project uses a restoration framework that provides management guidelines in frequent-fire forests (forests that historically experienced frequent, low-severity fire), which in the Southwest includes ponderosa pine and dry mixed conifer forests. The approach described by Reynolds and others (2013) emphasizes forest restoration, which would address many of the forest health issues being faced in the project area, providing well developed prescriptive restoration approaches. The intent of the framework is to inform management strategies that will shift these forest ecosystems toward reference conditions. Managing for the framework’s key elements should increase the resilience of the forests and facilitate opportunities for the resumption of characteristic function and disturbance regimes. The framework emphasizes vegetation composition and structure, describes expected outcomes, and presents management recommendations for implementation. Expected outcomes include: increased biodiversity, plant and animal habitats, and ecosystem services; increased resilience to insects, disease, and climate change; and reduced fuel loads and fire hazards.

Purpose and Need

The landscape within the project area has been greatly altered from historic conditions. Insects and disease have contributed to an overall decline in forest health in the area, which has led to high tree mortality and increased risk for uncharacteristic wildfire across the landscape. Wildlife habitat and watershed conditions have also declined as a result.

The purpose of the project is to restore overall forest health, watershed health, and wildlife habitat for each ecological response unit in the project area. There is a need to increase forest resiliency to insects, disease, and climate change by shifting forest structure, composition, and diversity toward desired conditions within the historic (or natural) range of variability for each forest type. There is also a need to reduce risks of uncharacteristic wildfires and to improve species habitat and watershed conditions.

Decision Framework

The Lincoln National Forest Supervisor (responsible official) must decide whether to approve the South Sacramento Restoration Project on National Forest System lands, and if so, under what terms and conditions, including adaptive management requirements.

The responsible official must also decide whether or not to approve a project-specific amendment to the Forest Plan that would authorize the use of restoration strategies in places and under conditions that were not foreseen when the current Forest Plan standards and guidelines were established in 1986 to meet project goals. The proposed amendment would modify Forest Plan standards and guidelines so new controls and technologies can be used where appropriate.

As a cooperating agency, the U.S. Fish and Wildlife Service also has a decision to be made related to the South Sacramento Restoration Project. Portions of the proposed action could be funded through various grant programs administered by the U.S. Fish and Wildlife Service, Wildlife and Sport Fish Restoration Program.

Public Involvement

On April 6, 2017, the notice of intent was published in the *Federal Register* announcing the preparation of an environmental impact statement for the proposed action. The published notice of intent initiated the formal 30-day public scoping period, which began April 7 and ended on May 8, 2017.

The Forest Service initiated informal scoping efforts in late February 2017, by inviting approximately 400 stakeholders to participate in a two-day Collaboration Workshop to discuss preliminary aspects of the project and collaboratively develop and refine the proposed action alternative. The workshop was held on March 15 and 16, 2017, in Cloudcroft, New Mexico, and was attended by 23 participants. A scoping letter was also mailed and emailed by the U.S. Forest Service on April 4, 2017, to 200 stakeholders, including private landowners, agencies, organizations, and tribes to inform the public of the project and to announce a public meeting on April 26, 2017.

Thirteen comment letters were received during the scoping comment period. The comments were either used to develop the proposed action or to identify the issues to be addressed in the environmental analysis. Detailed information about these meetings and scoping can be found in the project record.

Issues

Several issues were identified through both public comments received during the scoping period and internal Forest Service discussions. Eight significant issues were addressed in the analysis for the project:

- **Soil and Water—**impacts of soil disturbance and compaction, soil heating, erosion and sedimentation.
- **Nonnative Invasive Species—**establishment in areas of disturbance, and displacement of native species.
- **Rangeland and Livestock Management—**disturbance and displacement of livestock, loss of forage, and impacts to rangeland infrastructure.
- **Mexican Spotted Owl—**disturbance to habitat and critical life functions, especially in established nest core areas.
- **Other Wildlife and Plants—**disturbance to habitat structure and composition and disruption to critical life functions.
- **Vegetation and Ecosystem Structure and Function—**impacts to old growth, stand composition, fire behavior, and ecosystem processes.

- **Access and Closures—**restrictions for general forest users and visitors and access to inholdings and grazing allotments.
- **Social and Economic Conditions—**visual impacts, air quality impacts, noise intrusion, and health and safety hazards.

Alternatives

Two alternatives were evaluated in detail, as described below. One additional alternative was considered but eliminated from detailed study.

Alternative—No Action

Under this alternative, no new vegetation thinning, prescribed fire, herbicide, or watershed improvement treatments would be implemented in the project area. Implementation of any previously approved projects and planning of future projects that may affect the area would continue (e.g., fire suppression, management of nonnative invasive plants, fuels reduction projects, rangeland management, road maintenance, and others). The no action alternative for this project includes consideration of long-term projections of forest conditions and trends and wildland fire risk. The no action alternative does not address the purpose and need for the project; however, it serves as a baseline against which the effects of the action alternative can be compared.

Alternative 2—The Proposed Action

This alternative would conduct restoration activities on approximately 140,000 acres in the southern Sacramento Mountains over the next 10 to 20 years to meet initial project objectives, with additional maintenance treatments beyond 20 years. Restoration activities would occur in all ecosystems in the area, including mixed conifer, ponderosa pine, pinyon-juniper, riparian areas, meadows, and aspen habitat types. Restoration activities would focus on thinning and burning treatments to improve forest health and resiliency by reducing stand density, continuity, and homogeneity (sameness of forest structure and species composition) and increase heterogeneity (diverse forest structure and species composition) at a landscape scale, mid-scale, and fine scale.

The project area includes areas of the Lincoln National Forest, Sacramento Ranger District that either have not been previously treated or that were previously treated but require additional treatments to support forest restoration and other habitat management goals. Treatments would be aligned with old-growth development and large-tree retention objectives, which are ecosystem components that are generally lacking in the project area.

The proposed action is designed to provide a wide range of restoration methods that could be used to achieve desired conditions at the fine scale, mid-scale, and landscape scale. Each restoration method has a related set of tools that may be used on any given location, depending on the characteristics of the specific treatment site, such as vegetation type, topography, presence of federally listed species, etc. (Table ES.1).

Table ES.1. Summary of Restoration Methods and Associated Activities that Comprise the Proposed Action, with Acreage

Restoration Method/Associated Activities	Tools to Be Used for Implementation	Approximate Acres or Miles of each Activity
<u>Vegetation Thinning</u> Free Thinning of all Tree Sizes Thin from Below Group Selection with Matrix Thinning between Groups	• Hand thinning • Mechanical whole tree • Manual harvesting • Cut to length • Skyline yarding • Machine piling • Mastication	53,910 acres
<u>Use of Fire</u> Prescribed Fire Management of Wildfire to Meet Multiple Objectives	• Broadcast burning • Pile burning • Jackpot burning • Mobile incinerators	108,120 acres
Herbicide Applications	• Daubing or wicking and wiping • Foliar application • Basal bark • Frill or hack and squirt • Cut-stump	Within the 140,000-acre project area to control oak and juniper resprouts
<u>Other Restoration Methods</u> Site Rehabilitation and Planting Watershed Improvement and Erosion Control Water Developments Recreation Sites Interpretive Sites	• Multiple tools	Within the 140,000-acre project area, where needed
Special Use Authorizations	• Potential locations for forest industry activities, such as sorting yards, log processing sites, mobile incinerator sites, etc.	Within the 140,000-acre project area, where siting criteria allow
Road Management	• Road construction and reconstruction • Road maintenance and relocation • Temporary road closures • Rehabilitation of unauthorized routes	125 miles of temporary or system roads

This approach provides flexibility and is known as the “toolbox” approach. The Forest Service would apply the most appropriate tool or combination of tools to achieve desired results. Before carrying out treatments, project leaders would carefully look at the specific area to be treated and select the appropriate treatment tool(s) using an integrated resource process.

In order to implement the proposed action as described above, a project-specific amendment to the Forest Plan is needed that would authorize the use of restoration strategies in places and under conditions that were not foreseen when the current Forest Plan standards and guidelines were established in 1986. The proposed amendment would modify Forest Plan standards and guidelines so new controls and technologies can be used where appropriate. A project-specific plan amendment is a one-time variance in Forest Plan direction. Forest Plan standards and guidelines revert back to the original language for all other ongoing or future projects that may be authorized on the Lincoln National Forest unless additional amendments are made for those other projects.

The proposed changes to Forest Plan standards and guidelines relate to management of soil and water, recreation, timber, and fire and protection that would allow the best practices to be used. The changes to general species habitat management, and to Mexican spotted owl and northern goshawk management standards and guidelines, are also proposed. These changes would make the project consistent with the management objectives and current recovery plans and conservation agreements and/or other conservation measures identified through Endangered Species Act, Section 7 procedures.

The amendment would follow the 2012 Planning Rule per 36 Code of Federal Regulations (CFR) 219.17 (b)(2), and per the 2012 Planning Rule substantive requirements (36 CFR 219.8 through 219.11).

Environmental Consequences

Under Alternative 1, the No Action Alternative, none of the proposed restoration treatments would be implemented. Current conditions and trends in this area would continue. Key compositional and structural elements of forest stands would not be restored and ecological resistance and resiliency to environmental disturbance would be limited. Conifer forests would continue to exhibit overgrown and unnaturally high densities of small size-class trees. Vegetation communities that are adapted to and maintained by frequent low-severity surface fire would suffer continued departure from historical fire regimes. Nonnative invasive species would continue to displace native vegetation as well as rare and sensitive species, as soil surfaces are disturbed by high-severity wildfire. Stands would continue to be vulnerable to impacts of warmer temperatures and decreased precipitation resulting from climate change as well as more frequent insect and disease outbreaks; overall forest health would decline. Continued degradation would result in a long-term decrease in watershed function and resiliency, which poses a serious risk to soils and watershed resources.

Under the no action alternative there would be no project-related impacts to wildlife species because proposed project activities would not be implemented, however the vegetation trends previously described would continue to cause a decline in the quality of mature, mixed conifer forest habitat, resulting in habitat degradation for many wildlife species including threatened and endangered species. Adverse impacts on sensitive species, management indicator species, and migratory bird populations, and destruction of habitat from a severe wildfire is likely. Archaeological sites, recreation resources, and range resources would be adversely affected by roads, heavy fuel loads, and wildfire and suppression and rehabilitation activities. Without proposed forest restoration activities, no beneficial impacts to social or economic conditions would occur. Social conditions could possibly continue to decline as a result of there being no improvement in forest resiliency, ecosystem health, and local employment opportunities. Wildfire risk would continue to increase, therefore, potential wildfire suppression costs would be incurred by the Forest Service and damage costs to surrounding landowners, if a wildfire were to occur in the project area over the next 20 years.

Alternative 2, the proposed action, would meet the purpose and need by moving vegetation communities closer to historic conditions, returning historic fire regimes to fire-adapted vegetation, and reducing the risk of uncharacteristic catastrophic wildfire that impacts long-term woodland and forest health and threatens life, property, community values, and critical infrastructure. By altering stand structure and favoring larger, healthier trees, the incidence of insect and disease would be reduced across all vegetation types. By improving individual tree vigor and creating a more diverse age and size class structure within and between stands, native vegetation communities would move closer to desired conditions, improving ecosystem functioning.

There would be short-term negative effects during or immediately after treatments, including soil disturbance and sedimentation to streams as well as impacts on wildlife, grazing, air quality, visual quality, and recreation use. 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. Forage availability for livestock grazing would be temporarily impacted during implementation of vegetation treatments, but the Forest Service would work with permittees on their pasture rotations, so treatments would not directly interfere with operations. Roads closures could restrict access for general forest users and visitors and could affect access for recreation, hunting activities, and firewood collection. Because restoration activities would never occur across the entire project area at one time, and because of resource protection measures intended to minimize impacts, most impacts would be temporary and localized.

Air quality and human health would be affected by smoke for the duration of prescribed fires. Impacts on human health would vary depending on the individual's health, sensitivity, age, and other factors, and for some individuals, some problems may be long term and serious. The Forest Service would take measures to manage smoke impacts resulting from prescribed fire. As a result, the effects on air quality from prescribed fire would be short term and localized near the prescribed fire area.

The proposed action would help improve watershed function where impaired, as well as improve soil condition and productivity, hydrologic function of springs and seeps, and quality of perennial and intermittent waters and riparian areas through the proposed restoration methods. Restored forests also contribute to improved air quality, as they are more resilient to large-scale wildfire that adversely impact the airshed. By ensuring resilient ecosystems, the Forest Service can help to sustain local economic and social well-being, promote a sustainable flow of societal benefits, and manage multiple uses over the long term, so that these lands provide enduring ecosystem services and contribute to social and economic stability, as well. The proposed action would allow for beneficial economic impacts such as jobs, federal spending, timber revenues, and income to be recognized by the local communities within Otero County. By mitigating the potential for uncharacteristic wildfire, the proposed action also provides the best alternative for the protection of heritage resources, because this action will help to reduce the fuel loading within and near heritage resources and will help to reduce the intensity of wildfires.

Thinning and prescribed fire treatments are not expected to substantially alter habitats for federally listed, Forest Service sensitive, management indicator, or large game species or for migratory birds. Short-term, negative impacts to individuals may occur but treatments are expected to improve habitat conditions for all species and to reduce risk of uncharacteristic wildfires over the long term. Animals may be temporarily displaced during project implementation but would likely recolonize treated areas once activities cease. Impacts of herbicide use would be minor because limited areas would be treated at any one time. Some direct impacts to individuals may occur in the short term but treatments are expected to improve habitat suitability and forage availability over the long term. No impacts to species trends are expected.

The proposed action would likely disturb nesting pairs of Mexican spotted owl; however the actions would improve foraging, nesting, and roosting habitat for the species. Resource protection measures would ensure that planning and implementation of any project treatment activities will include pre-treatment evaluations and field surveys as needed for individuals of this species on all planned treatment locations prior to any treatment activities. The proposed action contains resource protection measures that minimize disturbance of the project actions to have no adverse effects on the Mexican spotted owl. The proposed action would retain and, in most cases, create the habitat attributes the owl and its prey base needs (e.g., large snags, downed woody material).

The Forest Plan amendment would result in both adverse and beneficial impacts to resources. The amendment components that would allow ground-based mechanized equipment to be used on slopes greater than 40 percent and allow forest restoration treatments to occur in Mexican spotted owl protected activity centers, northern goshawk habitat, and treatments within other essential habitat for federally listed species would result in short-term negative impacts as well as long-term beneficial impacts to threatened and endangered wildlife and would improve forest health and resilience in a larger portion of the project area, thereby resulting in decrease in wildfire potential. Updates to herbicide use direction to allow chemical treatments to control juniper and oak resprouts would help move vegetation communities closer to desired conditions and contribute to a reduction in hazardous fuel loading, mitigating the risk of uncharacteristically high-severity wildfire. The Forest Plan amendment to authorize the management of unplanned wildfires for multiple resource objectives across portions of the project area where this management is not currently authorized, would also result in long-term reduction in wildfire risk and long beneficial impacts to vegetation community resources, wildlife, and watershed functioning. The reintroduction of fire would help to bring vegetation communities back to within their range of natural variability and help to restore historic fire regimes. By authorizing the management of unplanned wildfire, fewer damaging suppression techniques would need to be applied to areas where fire can safely burn without threatening life and property.

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Chapter 1 Purpose and Need

1.1 Introduction

The U.S. Forest Service, Lincoln National Forest (Forest Service), in cooperation with the U.S. Fish and Wildlife Service and New Mexico Department of Game and Fish, is developing the South Sacramento Restoration Project (project), which would address forest health issues, hazardous fuels, and declining wildlife habitat quality on the Sacramento Ranger District at a landscape scale. This environmental impact statement has been prepared to disclose the impacts of the proposed project on the natural and human environment. The project is being developed under Section 602 of the Healthy Forest Restoration Act of 2003, also known as the Farm Bill authority. The 2014 Farm Bill provides opportunities to identify priority areas for treatment due to threats from forest insects and disease. Under Section 602(d) of the Healthy Forest Restoration Act as amended by the 2014 Farm Bill, priority projects that reduce the risk or extent of, or increase the resilience to, insect or disease infestation may be carried out in designated areas in accordance with Sections 102(b)(c)(d), 104, 105, and 106 of the Healthy Forest Restoration Act, which provides for expedited reviews under the National Environmental Policy Act, pre-decisional objection review, and guidance on judicial review. This authority is available for projects for which scoping has been initiated by September 30, 2018. The South Sacramento Restoration Project area falls within the area designated as part of an insect and disease treatment program according to Section 602 requirements. The project area is experiencing forest health decline based on annual forest health surveys and is at risk of experiencing substantially increased tree mortality based on the most recent Forest Health Protection Insect and Disease Risk Map (U.S. Forest Service 2014a).

Forested landscapes in the southwestern United States have become increasingly susceptible to large-scale, high-severity wildfires and insect and disease outbreaks. These landscapes are also increasingly prone to altered plant and animal habitats, leading to reduced biodiversity, ecological function, resilience, and sustainability. Mixed conifer, ponderosa pine, and pinyon-juniper forests in the southwestern United States are experiencing altered plant and animal demographics, reduced structural and spatial heterogeneity of vegetation, reduced productivity and biodiversity, and impaired ecosystem processes and functions. Furthermore, ecosystem services such as clean air and water, water yield, wood products, recreation, aesthetic and spiritual experiences, old-growth, nutrient cycling, pollination, and carbon sequestration have been altered and are now more vulnerable to rapid degradation by uncharacteristic wildfires and insect epidemics (Reynolds and others 2013).

Compared with today’s forests, historical mixed conifer–frequent fire forests had higher proportions of fire-resistant, shade-intolerant tree species; lower tree densities; a more open structure composed of higher proportions of large, old trees; and more tree groups or patches separated by open space. The composition, structure, and spatial pattern in frequent-fire forests—primarily ponderosa pine and mixed conifer–frequent fire forests—were predominantly maintained by frequent, low-severity surface fires. Some mixed conifer–frequent fire forests and ponderosa pine-shrub communities experienced mixed-severity fires, which included combinations of surface and crown fires, sometimes resulting in larger patches of tree groups. Frequent-fire forests had a characteristic uneven-aged structure consisting of a temporally shifting mosaic of different-aged tree groups and scattered individual trees in an open grass-forb-shrub matrix—a spatial and temporal pattern that provided and sustained plant and animal habitat adjacency, local biodiversity, and food webs (Reynolds and others 2013).

Current land management goals for Southwest forests include restoring the landscape toward ecosystem functionality and resilience under a changing climate. Restoration is the process of assisting the recovery of degraded ecosystems. Restoration initiates or accelerates ecosystem recovery with respect to ecological health (productivity), integrity (species composition, community and ecosystem structure), and sustainability (resistance and resilience to disturbance). Ecosystem resiliency is the ability of an ecosystem to absorb and recover from disturbances without altering its inherent function. A functioning ecosystem provides opportunities for sustaining plant and animal habitats and populations, increased biodiversity, nutrient cycling, carbon sequestration, air quality, water quality and quantity, wood products, forage, recreation, and aesthetic and spiritual experiences. Restoring forest composition and structure improves ecosystem function and resiliency (Reynolds and others 2013).

Ecological restoration is a process that assists recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. The objective of ecological restoration is to reestablish and retain biodiversity, health and productivity, ecological function, and resilience of National Forest System lands.

1.2 Project Area Overview

The project area covers approximately 140,000 acres on the Sacramento Ranger District of the Lincoln National Forest (Figure 1-1). The area covers portions of three fifth-level hydrologic unit code watersheds: Rio Peñasco, Salt Basin, and Tularosa Valley. Numerous communities are adjacent to the project area, including Cloudcroft, Timberon, Weed, Sacramento, and Sunspot, New Mexico. Non-federal lands (New Mexico State Trust lands), are also included within the planning boundary, so the consequences of restoring these ecosystems can be understood across the entire landscape.

The legal description of the project area is:

- Township (T) 16 South (S), Range (R) 11 East (E), Sections 23–27, 34–36
- T 16 S, R 12 E, Sections 19–36
- T 16 S, R 13 E, Sections 29–34
- T 17 S, R 11 E, Sections 1–3, 9–16, 21–29, 32–36
- T 17 S, R 12 E, Sections 1–36
- T 17 S, R 13 E, Sections 3–10, 16–21, 27–36
- T 18 S, R 11 E, Sections 1–5, 8–17, 20–27, 35, 36
- T 18 S, R 12 E, Sections 1–36
- T 18 S, R 13 E, Sections 1–9, 16–20, 30, 31
- T 18 S, R 14 E, Sections 31–35
- T 19 S, R 13 E, Sections 1–3, 6–8, 10–28
- T 19 S, R 14 E, Sections 2–11, 14–22, 29, 30

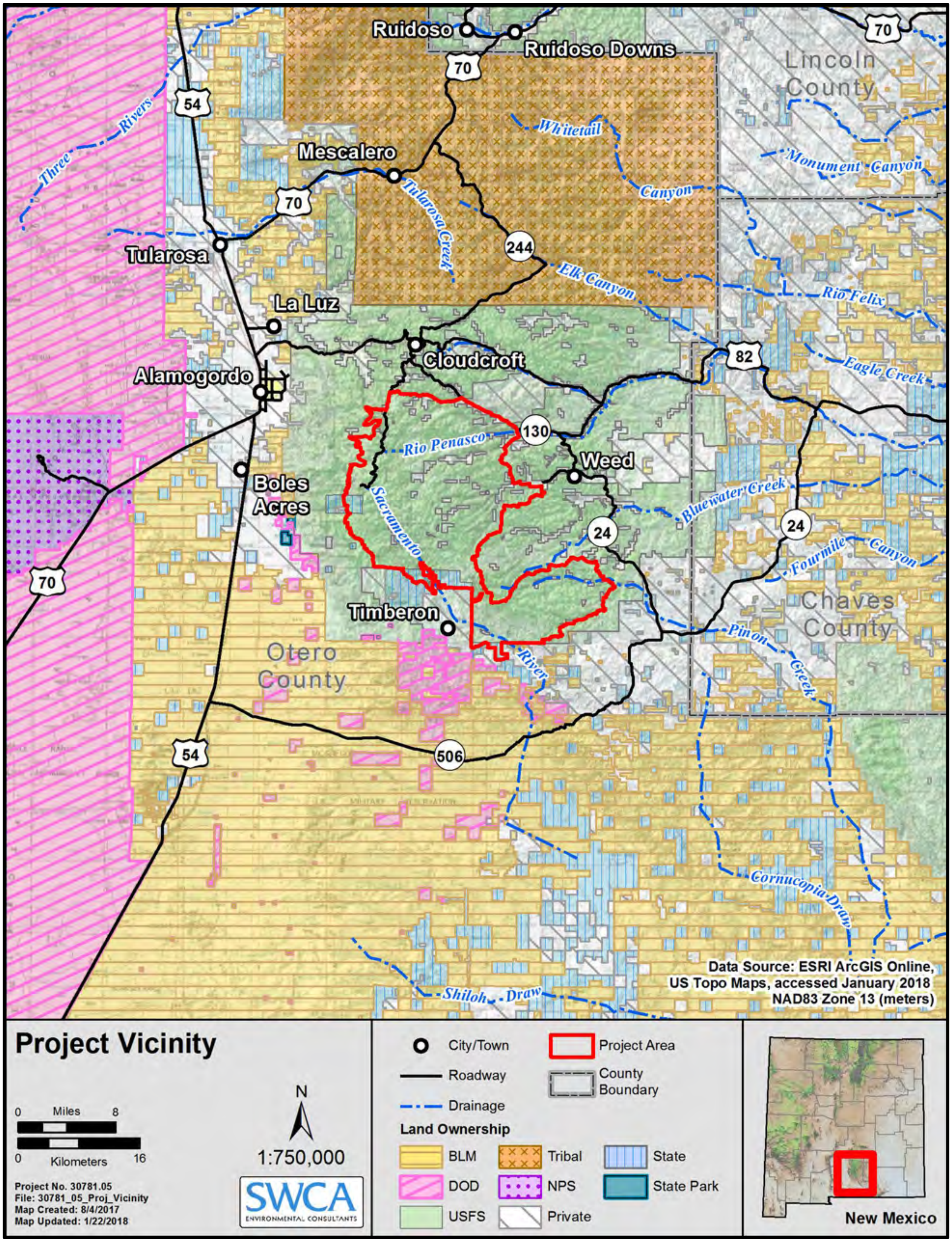

Figure 1-1. Vicinity map.

Mixed conifer forest, ponderosa pine forest, and pinyon-juniper woodlands and grasslands are the most common vegetation community types in the project area. The project area is characterized by dense, even-aged stands with a limited herbaceous understory. Over time, forest composition has shifted from stands dominated by shade-intolerant species to shade-tolerant species that are typically less resistant to moderate- and high-severity fire. Common tree species in mixed conifer forests include: white fir (*Abies concolor*), Douglas-fir (*Pseudotsuga menziesii*), southwestern white pine (*Pinus strobiformis*), aspen (*Populous tremuloides*), and ponderosa pine (*Pinus ponderosa*). Ponderosa pine forests are dominated by ponderosa pine with other conifer and hardwood species as codominant species or in the understory. Pinyon-juniper habitats are dominated by pinyon pine (*Pinus edulis*), one-seed juniper (*Juniperus monosperma*), and alligator juniper (*Juniperus deppeana*). Gambel oak (*Quercus gambelii*) is present in all vegetation types. Narrow meadows exist throughout the area and are largely dominated by Kentucky bluegrass (*Poa pratensis*) in the higher elevations and blue grama (*Bouteloua gracilis*) in the pinyon-juniper dominated lower elevations.

The illustration in Figure 1-2 shows the general changes in forest type in the Southwest as influenced by elevation and aspect (Reynolds and others 2013).

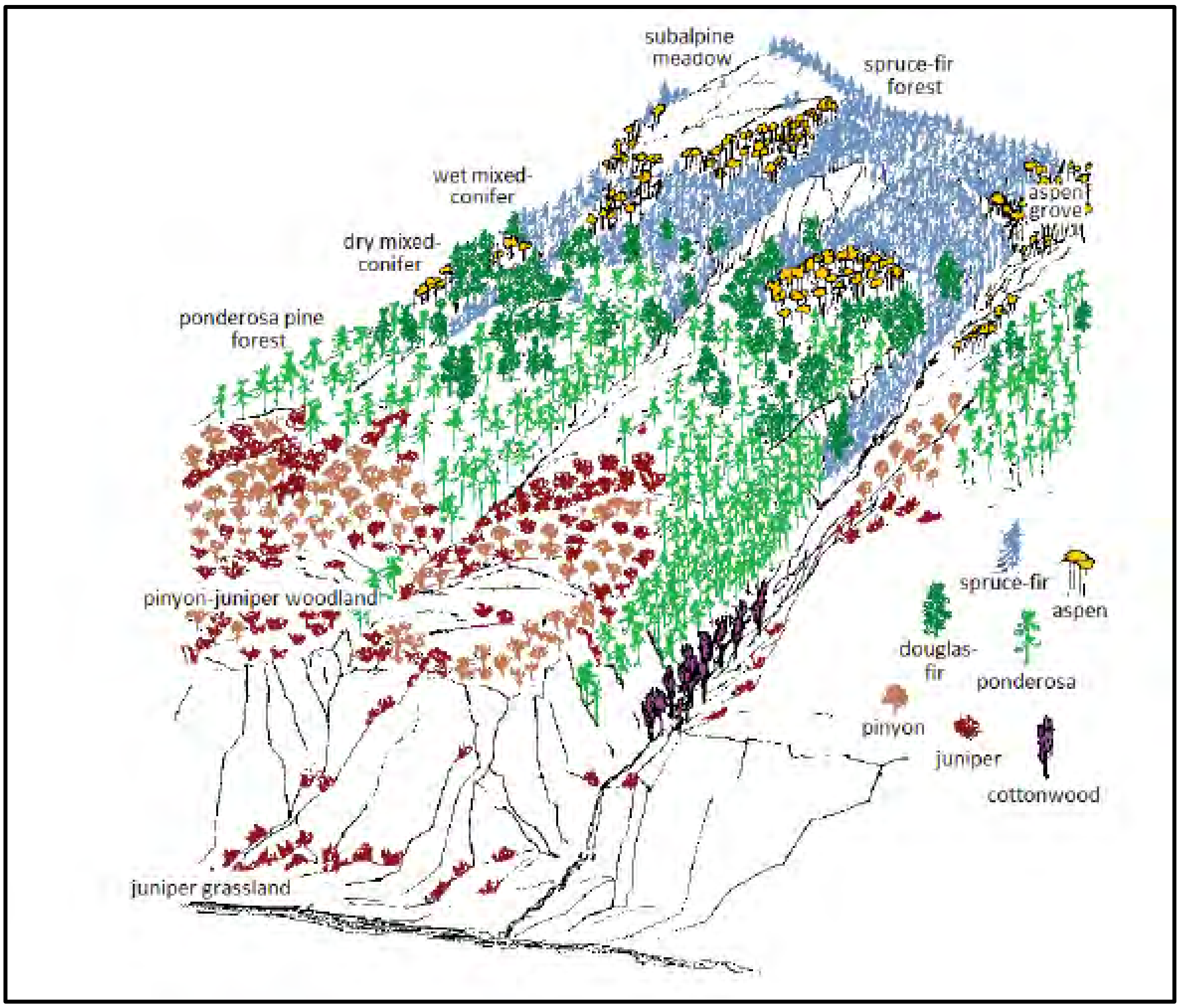

Figure 1-2. Illustration of Southwest forest types as influenced by elevation and aspect.

Slopes in the project area are highly variable, with deeply incised canyons. Elevations in the project area range from approximately 6,400 to 9,700 feet. Most of the drainages within the project area are intermittent or ephemeral. Riparian vegetation persists along the Sacramento River, Agua Chiquita, Rio Peñasco, and Wills Canyon, and at scattered seeps and springs. Most of the riparian vegetation is herbaceous, with little to no woody riparian vegetation.

1.3 Restoration Framework

Restoration of key compositional and structural elements on a per-site basis is expected to restore resiliency of Southwest forests, and thereby position them to better resist and adapt to future disturbances and climates. General Technical Report RMRS-GTR-310 (Reynolds and others 2013), Kaufmann and others (1998), Cram and others (2017), and the current Mexican spotted owl (*Strix occidentalis lucida*) recovery plan (U.S. Fish and Wildlife Service 2012) provide a management framework that is designed to improve the resiliency of these forest landscapes by restoring the composition, structure, and spatial patterns of vegetation. The restoration framework was developed to provide management guidelines in frequent-fire forests (forests that historically experienced frequent, low-severity fire), which in the Southwest include ponderosa pine and dry mixed conifer forests.

Fires become less frequent and more severe with increasing elevation due to an increasing moisture gradient. These higher forests produce greater amounts of woody fuel but are not dry enough to burn as often, making for fewer fires that burn more intensely. Fire regime studies, called fire histories, have been done in the Sacramento Mountains. This research found a range of average fire intervals at one fire every 2.6 years (± 1.8 years) in a southwest-facing ponderosa pine stand, to one fire every 13.8 years (± 5.5 years) in a northeast-facing mixed conifer stand (Brown and others 2001). On the lower and drier end of the gradient, where we find pinyon-juniper communities, productivity limits the frequency of fires due to lack of fuel continuity. Fire histories are problematic in pinyon-juniper woodlands since trees are usually killed and not scarred by fire and tree rings are irregular (Huffman and others 2008). Pinyon-juniper woodlands are thought to undergo frequent fire regimes where they are ecotonal (a transition zone) with ponderosa pine forests that experience fire on a 7- to 11-year frequency. In non-ecotonal persistent woodland sites, fire rotations of over 290 years could occur, exhibiting limited extent but high mortality patches (Huffman and others 2008).

The approach described by Reynolds and others (2013) emphasizes forest restoration, which would address many of the forest health issues being faced in the project area providing well developed prescriptive recommendations for two primary forest types, ponderosa pine and mixed conifer–frequent fire forest. It provides more general guidance and restoration approaches for in the adjacent mixed conifer with aspen forest and pinyon-juniper woodlands. However, extensive research work in the other vegetation communities provide insights into fire ecology and restoration strategies in these forest and woodland types that are included in this restoration framework (Cram and others 2006; Kaufmann and others 1998; O’Connor and others 2016; Fulé and others 2003; and Mast and Wolf 2006).

Forest ecology, historical conditions (Kaufmann and others 1998), and the historic range of variability are frequently used to define restoration goals, to estimate the restoration potential of sites, and to evaluate the success of restoration efforts. Historic range of variability is useful for understanding the natural variability in composition, structure, processes, and functions among sites and for understanding the dynamic nature of ecosystems. It is also a useful reference for establishing limits of acceptable change for ecosystem components and processes. The framework identifies key elements that characterized Southwest forests before industrial logging and the disruption of historical disturbance regimes. As identified by Reynolds and others (2013) and Margolis and others (2013), these key compositional and structural elements are:

- species composition (tree and understory vegetation);
- groups of trees;

- scattered individual trees;
- open grass-forb-shrub interspaces between tree groups and individual trees;
- snags, logs, and woody debris; and
- variation in the arrangements of these elements in space and time.

The key elements provide inferences about species compositions, structural conditions, and the cumulative effects of disturbances on processes and functions that provide Southwest forests with resistance and resilience to disturbance (Reynolds and others 2013).

The framework is based on the assumption that managing these forest ecosystems toward reference conditions and ranges of natural variation (range of reference conditions within a specific ecosystem and time period) should allow the reestablishment of characteristic processes. By shifting ecosystems back to reference conditions, forests would be more likely to withstand and adapt to stressors such as fire, insects, disease, and drought. Recognizing that reference conditions in frequent-fire forest may become less relevant in changing climates, restoring their composition, structure, and characteristic processes today is expected to aid the retention of ecosystem components in the near term, while research and land management agencies develop new methods and strategies that would contribute to adaptive ecosystem management in the future (Reynolds and others 2013).

The intent of the framework is to inform management strategies that will shift these forest ecosystems toward reference conditions. Managing for the framework’s key elements should increase the resilience of the forests and facilitate opportunities for the resumption of characteristic function and disturbance regimes. The framework emphasizes vegetation composition and structure, describes expected outcomes, and presents management recommendations for implementation. Expected outcomes include: increased biodiversity, plant and animal habitats, and ecosystem services; increased resilience to insects, disease, and climate change; and reduced fuel loads and fire hazards. The application of this framework should be flexible and adaptive; its conceptual approach will provide a blueprint against which management plans and practices can be evaluated (Reynolds and others 2013).

The framework is organized around key compositional and structural elements at three spatial scales and is based on a synthesis of reference conditions, literature on the ecology of frequent-fire forests, our understanding of the ecology of these forests, decades of collective experience of forest managers and researchers as described in General Technical Report RMRS-GTR-310, U.S. Forest Service Southwestern Region desired condition guidance, and lessons learned during applications of this framework in Southwest forests (Margolis and others 2013; Reynolds and others 2013; U.S. Forest Service 2014b).

Desired conditions within the South Sacramento Restoration Project area are characterized at three spatial scales:

- Fine scale (less than 10 acres)
- Mid-scale (10 to 1,000 acres)
- Landscape scale (1,000 to 10,000 or more acres)

The landscape scale provides the “big picture” of the desired conditions across the larger land area. The landscape scale is composed of aggregates of mid-scale units and usually has variable elevations, slopes, aspects, soil types, plant associations, disturbance processes, and land uses. The proposed project is a landscape-scale project, and development of the proposed action (provided in Chapter 2) has been informed by analyzing available data and modeling at the landscape scale.

Mid- and fine scales provide additional details necessary for guiding site-specific projects and activities. These scales generally correspond to forest structural features. The fine scale is an area in which the species composition—age, structure, and spatial distribution of trees (single and grouped)—and grass-forb-shrub interspaces are expressed. Aggregates (groups or clusters) of fine-scale units comprise mid-scale patches or stands, which are relatively homogeneous in vegetation composition and structure. Implementation of the proposed project would happen at the mid- and fine scales. Figure 1-3 illustrates the three spatial scales used to describe desired conditions for each vegetation type (Reynolds and others 2013).

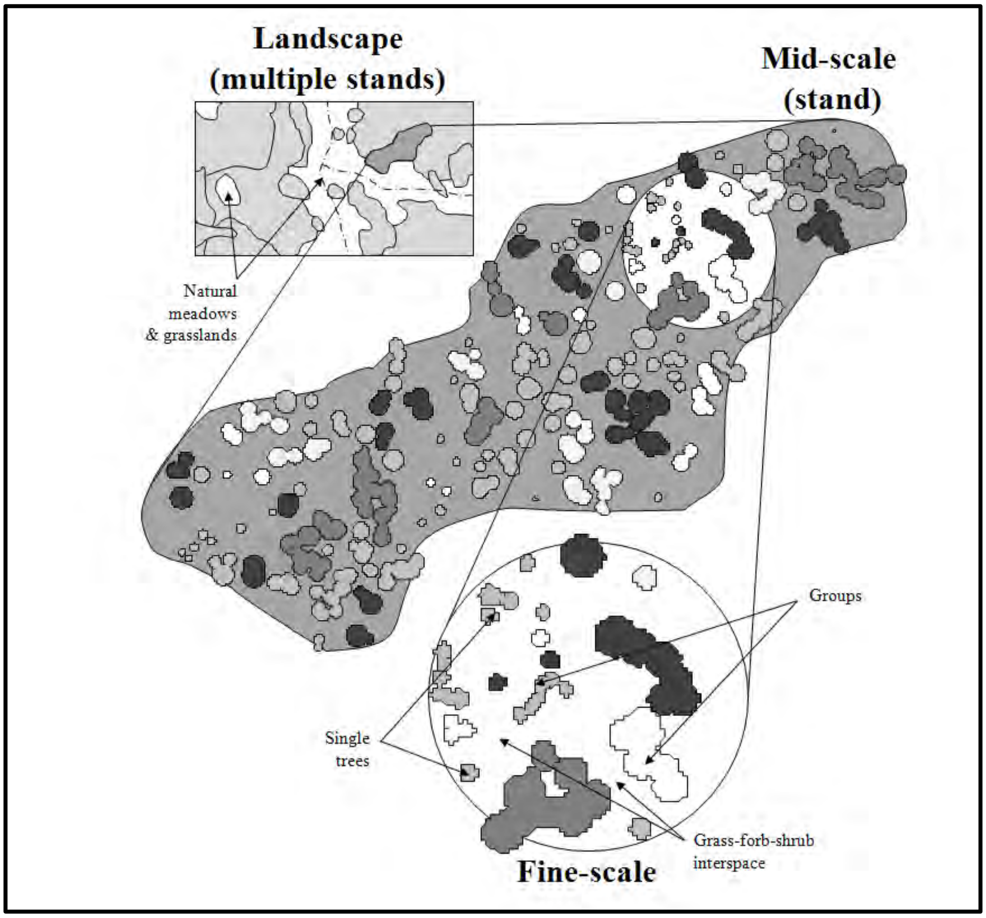

Figure 1-3. Illustration of the three spatial scales (source: Reynolds and others 2013).

The restoration framework relies on desired condition objectives defined for ecological response units, which are generally described as vegetative communities. These units represent an ecosystem stratification based on vegetation characteristics that would occur when natural disturbance regimes and biological processes prevail and combine potential vegetation and historical fire regimes to form ecosystem classes useful for landscape assessment (U.S. Forest Service 2014b, 2015a).Table 1-1 says the primary ecological response units that occur in the project area. Acreage estimates include non-federal lands (state, private, etc.) within the project area boundary.

Table 1-1. Ecological Response Units and Their Approximate Acreage in the South Sacramento Restoration Project Area

Ecological Response Unit	Approximate Acres in Project Area
Mixed Conifer with Aspen Forest	27,613
Montane/Subalpine Grassland	4,705
Mixed Conifer–Frequent Fire Forest	63,978
Ponderosa Pine Forest	17,450
Pinyon-Juniper Woodland	18,998
Gambel Oak Shrubland	1,117
Pinyon-Juniper Grassland	222
Mountain Mahogany Mixed Shrubland	6,088
Total	**140,171**

Specific restoration objectives for each ecological response unit within the project area are described in detail in Section 1.4.1, Existing and Desired Conditions. Desired conditions for pinyon-juniper woodlands, fire hazard reduction in the wildland–urban interface, watershed health, socioeconomics, and Mexican spotted owl habitat protection and development objectives are also addressed below.

The types, frequencies, and severities of disturbances (e.g., fires, insects, and diseases) played an important role in shaping the historical composition, structure, and function of Southwest forests. Therefore, where forest composition and its structure allow, the framework recommends that fire, the primary historical disturbance agent in these forests, play a prominent role in their restoration. The framework also emphasizes that mechanical treatments may be necessary to initiate suitable compositions and structures before reintroducing fire. Where use of fire is limited, mechanical treatments may be the only available tool to create and maintain restored forests. Conversely, fire may be the only suitable tool for some areas. Restoration provides opportunities for the reestablishment of the characteristic disturbance regimes as well as the spatial and temporal links between pattern and process (e.g., the feedback relationship between forest structure and fire) that sustained the characteristic composition and structure of these forests. Implementation of this framework should improve overall ecosystem productivity and function and enhance ecosystem services such as soil productivity, biodiversity, wildlife habitat, clean air, water quality and quantity, wood products, and recreation. More information about the proposed action, which would be used to implement the restoration framework within the project area, is provided in Chapter 2.

1.3.1 Reference Conditions Used to Develop the Proposed Action

The restoration framework recognizes that it may not be feasible for management to approximate the historical composition and structure patterns or fully restore characteristic ecological processes and functions everywhere. Climate change may be one of several factors that prevent a site from reaching desired conditions. Other factors could include change in hydrology due to grazing activities or a change in species diversity.

Using a reference period of indigenous settlement that occurred from the 1500s to the late 1800s, the historic range of variability first describes the range of ecological conditions that occurred on Lincoln National Forest lands under more "natural" disturbance regimes. Conditions occurring during this period represent those that existed prior to European-American settlement, which introduced sweeping ecological changes due to activities such as large-scale timber harvest, livestock grazing, fire suppression, dams, consumptive water uses, and roads. The historic range of variability is then used to evaluate the current ecological conditions of ecosystems on Lincoln National Forest lands by comparing them with the ecological conditions that occurred during the reference period.

The intent is to use historic range of variability to better describe and understand ecosystems within Lincoln National Forest lands and to help develop reasonable desired conditions that are intended to protect and sustain ecosystems and species, while meeting a variety of public needs where possible. The intent is not to mandate that historic range of variability conditions be achieved in all cases.

In an effort to ensure that the proposed action is able to adapt to changing conditions on the landscape, whether that be climate change or other factors, the Implementation, Adaptive Management, and Maintenance section of Section 2.2.2, Alternative 2 – Proposed Action, outlines the adaptive management and monitoring approach the Forest Service would use throughout the life of the project.

1.4 Purpose and Need for Action

The landscape within the project area has been greatly altered from historic conditions. Insects and disease have contributed to an overall decline in forest health in the area, which has led to high tree mortality and increased risk for uncharacteristic wildfire across the landscape. Wildlife habitat and watershed conditions have also declined as a result.

The purpose of the project is to restore overall forest health, watershed health, and wildlife habitat for each ecological response unit in the project area. There is a need to increase forest resiliency to insects, disease, and climate change by shifting forest structure, composition, and diversity toward desired conditions within the historic (or natural) range of variability for each forest type.

Additionally, mitigation of hazardous fuels and uncharacteristic wildfire is a driving force of the project. There is a need to reduce high-severity fire risks and post-fire flooding potential to protect life, property, and natural resources by reducing the acres currently classified as having high, very high, and extreme crown fire hazard potential across the project area. More specifically, there is a need to reduce the potential for crown fire and high-intensity surface fire, which would reduce the impacts of unplanned ignitions. There is also a need to increase the ability of fire suppression crews to use direct suppression tactics to control a wildfire occurring within the project area.

In Mexican spotted owl habitat, there is a need to protect existing habitat and promote development of future habitat suitable for nesting, roosting, foraging, and dispersal to further recovery of the species. Additionally, there is a need to increase our understanding of the short- and long-term effects of land management on existing and future suitable habitat.

Where watershed function is impaired, there is a need to improve soil condition and productivity; hydrologic function of springs and seeps; and quality of perennial and intermittent waters and riparian areas.

The proposed project requires an amendment to the Lincoln National Forest Land and Resource Management Plan (Forest Plan). This amendment would authorize the use of restoration strategies in places and under conditions that were not foreseen when the current Forest Plan standards and guidelines were established in 1986.

The following sections pertaining to resources within the project area further detail the existing conditions, desired conditions, and need for change.

1.4.1 Existing and Desired Conditions

Desired conditions are generally described as how vegetative communities should look and function when restored. Local ecological conditions vary across the region and there may be a need to make adjustments to account for unique situations. Desired conditions reflect the characteristics necessary to restore and sustain ecosystems, including structure, composition, landscape patterns, and processes, and to provide for the habitats of Mexican spotted owls and other native species. They also provide for the development of old-growth characteristics. Ecological restoration is an outcome of managing for desired conditions.

Forest Health

Endemic insects and diseases are important disturbance agents that can shape spatial patterns of forested landscapes. Under historical forest conditions, it is likely that large-scale, contiguous insect and disease outbreaks were rare (Colorado Forest Restoration Institute 2010; Kaufmann and others 1998). Therefore, it is unlikely that insects and diseases threatened long-term stability and productivity of forests under historic conditions. It is more likely that dwarf mistletoe (*Arceuthobium* spp.) would have thrived in dense, multi-storied pockets within stands that escaped natural thinning via fire, wind throw, and other disturbances. In these pockets, periodic tree mortality would have occurred directly from mistletoe infection, insects, or root disease. Such mortality would have created snags, coarse woody debris, and stand openings that would eventually serve as regeneration sites.

Forest health is defined by the vigor and condition of the forest stands and the presence of insects and disease that affect the sustainability of the forest. When large, uncharacteristic insect and disease outbreaks occur, profound changes to the composition, structure, processes, and functions of forests often take place. Insects and diseases affect nearly all aspects of forest stand dynamics, from seed viability to seedling survival, from bud, shoot, and leaf production to growth and maintenance, and, ultimately, the survival and distribution of mature trees (Reynolds and others 2013). In the project area, an estimated 82,900 acres is at high risk of insect- and disease-caused tree mortality, according to the localized version of National Insect and Disease Risk Maps (Krist and others 2014).

Bark beetles and defoliating insects are naturally occurring influences in Southwest forests, where outbreaks are strongly linked to climatic factors, such as prolonged drought periods and high tree densities (Figure 1-4). Substantial mortality of pinyon, ponderosa pine, Douglas-fir, and white fir was observed during 2011 to 2013, when several bark beetle species had increased populations following a period of severe drought. Wildfires also predispose surviving trees to bark beetle attack and can lead to additional tree mortality in adjacent non-burned areas, particularly of Douglas-fir. Dense forest stands are at elevated risk to bark beetle-caused tree mortality because stressed trees are competing for water and nutrients, making these stands conducive for bark beetle attacks. Due to increased annual precipitation the past few years in the area, recent bark beetle activity on the Sacramento Ranger District has been occurring at low levels among most forest types (U.S. Forest Service 2016a).

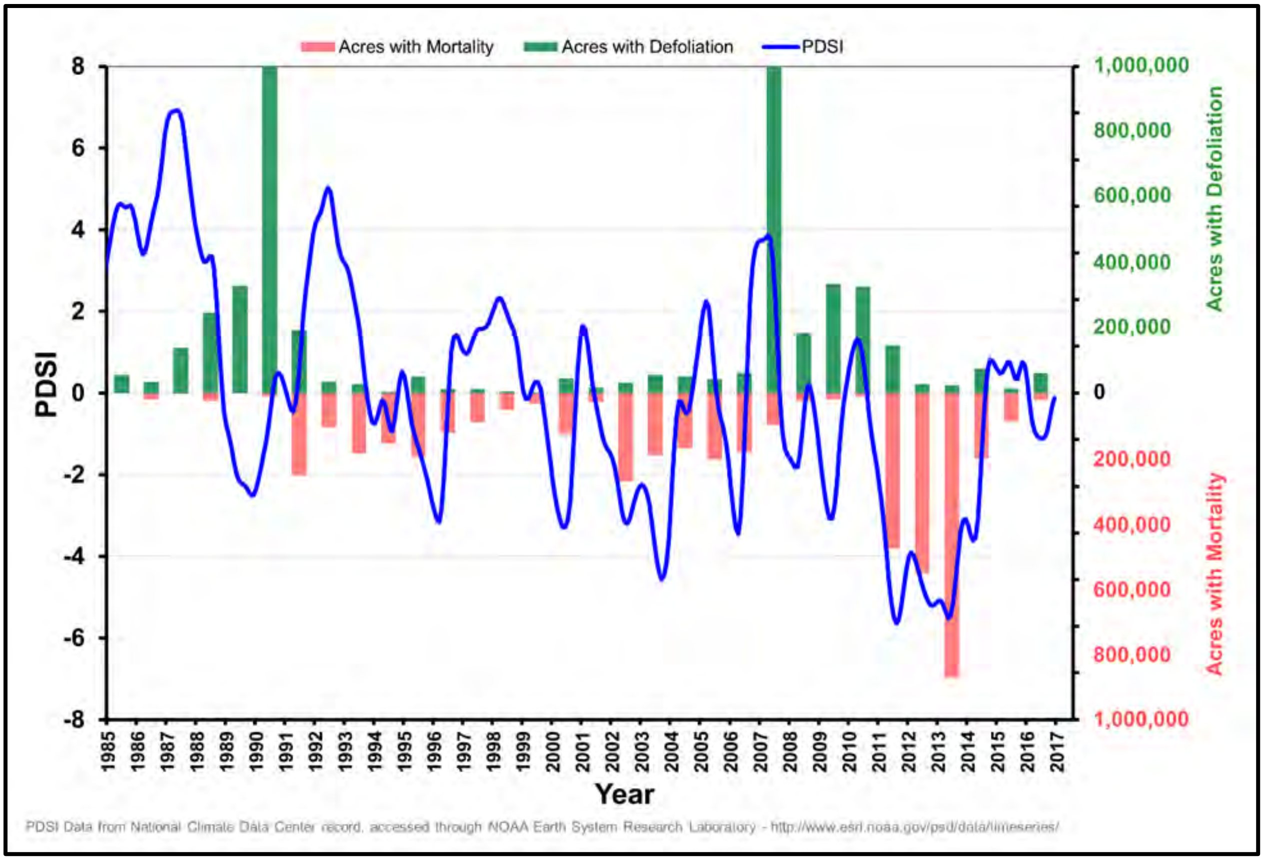

Figure 1-4. Palmer Drought Severity Index (PDSI) for New Mexico climate division 6 (central highlands division; which includes the South Sacramento Restoration Project area) with acres of mortality and defoliation from aerial detection survey results. Note: PDSI of 0 indicates normal conditions, and drought is shown in terms of negative numbers. For example, −2 is moderate drought, −3 is severe drought, and −4 is extreme drought. Data are from the National Climate Data Center record (National Oceanic and Atmospheric Administration Earth System Research Laboratory 2017).

The Sacramento Mountains are rather unique in New Mexico for the variety of forest-defoliating insects in the mixed conifer and spruce-fir forests that experience large outbreaks. Western spruce budworm (*Choristoneura occidentalis)* is prevalent on the Sacramento Mountains and causes defoliation. Douglas-fir tussock moth (*Orgyia pseudotsugata*) and at least two species of geometrid moths, or loopers, have reached outbreak populations several times during the last decade on the Sacramento Mountains, causing elevated mortality of white fir and Douglas-fir. Dense, contiguous forest stands of these shade-tolerant host species support outbreaks from these insects and can lead to large-scale disturbance events.

Dwarf mistletoe infection in ponderosa pine is common throughout the project area. Mistletoe-infected trees slowly weaken, experience reduced growth rates, and eventually die. Surveys in the 1980s determined the Lincoln National Forest has the highest level of incidence of ponderosa pine dwarf mistletoe of any National Forest in the Southwestern Region. Surveys estimated that 71 percent and 72 percent of the ponderosa pine type on the Cloudcroft and Mayhill Ranger Districts (combined into the current Sacramento Ranger District) were infected (Hessburg and Beatty 1986). Due to the slow spread and movement of dwarf mistletoes, it is expected that the level of mistletoe infection has remained fairly stable, with infected sites becoming more adversely affected over time. Stands with high levels of infection are difficult to regenerate because young trees typically die before reaching maturity.

In the Southwest, root diseases are more common in mixed conifer than in ponderosa pine forests because the mesic conditions are more favorable to both fungi and the susceptible host tree species. Aspen and either pine or fir are at risk to Ganoderma root rot and Heterobasidion root disease, respectively. Promoting tree vigor by reducing stand densities can reduce the impact of root diseases. White pine blister rust is an invasive pathogen that was first found affecting southwestern white pine in the Sacramento Mountains in 1990 and had likely been introduced to the region sometime in the early 1970s. Incidence of white pine blister rust throughout the mountain range ranged from 4.2 percent to 80 percent by the early 2000s, with an overall average incidence of about 40 percent and higher disease incidence associated with higher elevations.

The desired condition is to move toward a forest structure that would allow insects, dwarf mistletoe, root diseases, and other pathogens to function at naturally occurring or historical levels. There is a need to manage insect and disease in a manner that reduces, but does not eliminate, these influences, in order to provide nesting, resting, foraging, and catching sites for animals that use this type of habitat. The 2014 Farm Bill provides for opportunities to identify and treat areas experiencing forest health declines or that are at risk of experiencing substantially increased tree mortality due to insect and disease infestations.

Forest Structure

Ecosystems are structured hierarchically, and their composition, structure, processes, and functions are temporally and spatially dynamic. Understanding and incorporating temporal scales in a restoration framework, both short and long term, is required to sustain vegetation dynamics of forests that result from growth, succession, senescence, and the historical and anthropogenic disturbances that periodically reset these dynamics (Reynolds and others 2013). The temporal scale (e.g., centuries) recognizes the dynamic aspects of vegetation resulting from growth, senescence, succession, and the natural and anthropogenic disturbances that periodically influence these processes. Natural succession and disturbances such as wildfire and insect and disease mortality are the primary drivers that shift the spatial pattern of tree groups and the interspaces between tree groups over time. These natural influences shape tree spatial patterns at varying scales through its influence on seedling survival, with variability in the severity, seasonality, and frequency of fire.

Canopy density and openness; the relationship of vegetation structural stage to age/size class and diversity; stand density; key habitat components; and old growth are criteria used to describe forest structure and spatial pattern conditions. Frequent-fire forests typically comprise a mosaic pattern of groups of trees, scattered single trees, grass-forb-shrub interspaces, snags, logs, and woody debris. Structural heterogeneity in these forests is a consequence of interactions among biophysical site conditions (e.g., topography, soils, climate); disturbance types, frequencies, intensities, and extent; levels of competition among species; and tree demographic rates. Of studies that investigated the origin, distribution, and mortality of ponderosa pine forests, most reported uneven-aged reference conditions at the stand scale.

A characteristic of historical Southwest frequent-fire forests was the grass-forb-shrub openings (interspaces) interspersed among groups of trees. Overall, the desired condition is to reestablish interspaces at the mid- and fine-scale levels. These interspaces would comprise a large portion of the landscape as appropriate based on ecological response unit and other management goals. There would be a mix of very open, open, moderately closed, and closed-canopy conditions at the landscape scale. Moderate to closed-canopy conditions would be widely distributed on the landscape. Suitable habitat conditions for northern goshawk (*Accipiter gentilis*) and Mexican spotted owl, steep slopes, and buffers for other wildlife, caves, and other important landscape features would provide connectivity with moderate to closed-canopy conditions.

Succession is expected to reduce stand heterogeneity due to mortality, resulting in a gradual transition from a dense canopy to more uniform and open spacing of trees. Mortality over time may also gradually reduce within-group tree density, resulting in increased variation in tree densities and ages within and among groups.

The structure of forest vegetation is also affected by disturbances such as fire, insects, disease, wind, and drought. Dense forest structures can facilitate crown fire by providing a potential path for fire through tree crowns. Forest density further influences surface and canopy fuels through interactions with insects and diseases. The effects of bark beetles in ponderosa pine stands are more pronounced during and following extended droughts and under dense stand conditions, both of which are conducive to the survival and reproduction of beetle populations (Negrón 1997). Additionally, trees with heavy mistletoe infection are more susceptible to severe crown scorch and death from fires (Reynolds and others 2013).

Forest canopies influence the composition and abundance of surface fuels, which are essential to facilitate fire as a disturbance agent. Surface fuels also offer nutrients to soils, help reduce erosion, and influence understory vegetation productivity, density, and diversity. Fine fuels (grass, needles, cones, and woody material less than 0.25 inch in diameter) and small branches accumulate more rapidly under tree groups than in interspaces between tree groups. This accumulation facilitates fire, in turn restricting the establishment and persistence of trees and shrubs under tree groups. Furthermore, needle and twig litter will burn with higher intensity than herbaceous fuel under similar weather conditions (Reynolds and others 2013).

Forest structure affects the distribution, density, and composition of surface and canopy fuels, which affects the behavior of fire and, ultimately, post-fire forest structure. Depending on seed availability, some individuals and small groups of seedlings may establish throughout the stand, including under tree groups. Tree seedlings that established in small forest openings are often thinned by wildfires and/or other sources of mortality. Young tree groups in open areas reach fire-resistant sizes more rapidly than those beneath closed canopies. As trees grow, increasing needle and twig accumulations facilitate the spread of surface fire. Seedlings that establish some distance away from mature older trees are also more likely to survive fires due to less rapid accumulation of fine fuels and small branches from overstory trees, likely leading to less intense and severe fire and variable spacing of tree groups. The seasonality and burning conditions of fire occurrence also result in variable outcomes (Reynolds and others 2013).

Stand Density

There is a relationship between a healthy forest and its density. Essentially, how crowded is the forest? The denser the forest, the more individual trees have to compete for resources, such as water, light, and soil nutrients. The effects of competition on tree growth and death are profound—the more trees per acre, the smaller the diameter of the individual trees (meaning less growth) and the higher the likelihood trees will be negatively impacted by pests, diseases, and poor health, ultimately leading to tree mortality. The density and arrangement of forest canopies affects the penetration of sunlight. Essentially a full crown and a healthy root system will determine in large measure the vitality of a tree at any age. The most visible characteristic of tree vigor is a full canopy. Likewise, competition for growing space also affects tree roots and determines the ability of a tree to obtain water and nutrients from the soil.

Forest density factors into forest health across all scales but is usually measured by managers at mid-scale or stand level (10 to 1,000 acres). Measurements of forest density include basal area, trees per acre, and stand density index. *Basal area* is used to describe the average amount of an area occupied by tree stems and is measured in square feet per acre. *Trees per acre* is a count of the total number of trees on one acre. *Stand density index* uses both of these criteria to form a single relative index of tree density (Long and Smith 1984). These parameters are used to inform managers, drive forest growth and fire behavior models, develop wildlife habitat guidelines, and monitor for treatment effectiveness. Along with other descriptors, they help to describe the structure of a forest stand, its vulnerability to crown fire, its value for wildlife habitat, and its general long-term sustainability.

The desired condition is to reduce the potential for density-related mortality and have stand densities at levels that facilitate forest health. Healthy stand densities allow for overall forest development, tree vigor, and resilience to characteristic disturbances.

Old Growth

Old-growth forests provide many ecosystem services—plant and animal habitat, high-quality wood products, carbon sequestration, hydrologic function, aesthetics, and spiritual values. There are many definitions and synonyms for old growth, but all commonly refer to tree age (mature, old), tree size (large), tree decadence (some), and other structural features. Some define old growth as the climax or late-successional stage of forest development (Helms 2004). These definitions, however, ignore the old stages in early successional forests such as in quaking aspen stands that are successional to climax spruce-fir forests. An ecological understanding of old growth requires a perspective that includes multiple spatial and temporal scales, ranging from individual trees, to stands, to regions, and across forest types. While the structural and ecological definitions of old growth were first developed in the coastal Pacific Northwest (Er and Innes 2003; Spies and Franklin 1996), those particular definitions do not work for most forests in other ecological settings (Kaufmann and others 2007). This is because there are substantial differences in the species compositions, tree longevities, sizes, densities, and variations in the types, intensities, and frequencies of natural disturbances across forest types (Harmon and others 1986). These biological and ecological factors result in different tree structures, densities, distributions, and landscape patterns when a forest type is in its old stage. Because of the complex and dynamic nature of forests, efforts to conserve biodiversity by providing old growth in landscapes must take into account all developmental stages, not just old growth (Spies 2004).

From an ecosystem function viewpoint, there may be little difference between a completely undisturbed old-growth forest and a previously disturbed but fully restored old-growth forest. At its most fundamental level, old growth is the product of structures and processes associated with the maturation and senescence of a population of trees (Spies 2004). While past strategies for protecting old growth created reserves of existing old trees, many of these reserves in the Southwest are degraded. Degradation of old growth reserves is an outcome of the persistent interruption of frequent low-severity fires that historically typified Southwestern forests. To reverse this degradation, long-term management strategies are needed to develop dynamic landscape populations of old growth that are able to withstand wildfire, parasites, diseases, human disturbances, and climate change. Desired forest conditions that include all tree age classes and are based on forest restoration principles and objectives are such a strategy.

Definitive characteristics of old growth in the Southwest vary by forest type. This is because the tree species composition, longevity, size, and density, combined with the types, intensities, and frequencies of natural disturbances, vary by forest type (Harmon and others 1986). Classic ecological concepts and forestry language regarding old growth are not well suited to frequent-fire landscapes (Binkley and others 2007). Old-growth characteristics in the Southwest (Table 1-2) can be partitioned into forest conditions resulting from three different types of fire severity and frequency: 1) forests distinguished by frequent, low-severity fires that result in fine-scale groups of trees interspersed within a grass-forb-shrub matrix; 2) forests distinguished by an infrequent mixed-severity fire regime; and 3) forests distinguished by a very infrequent high-severity fire regime. A mixed-severity regime is characterized by infrequent high-severity, stand-replacing fires mixed with more frequent smaller-scale surface fires. Mixed-severity fire regimes typically have moderate to large and sometimes distinctive patches of forests reflecting patches burned infrequently at different times and more frequent smaller-scale surface fires within the larger patches (Fulé and others 2003; Grissimo-Mayer and others 1995). Mixed conifer with aspen forests and pinyon-juniper woodlands are mixed-severity fire forests. Ponderosa pine as well as mixed conifer in dry sites are frequent fire forests.

Table 1-2. Essential Structural Features of Old Growth in Fire-Adapted Forests

Structural Feature	Essential Structural Feature?	Notes
Large trees	No	Tree size depends on species and site characteristics (moisture, soils, and competition). Young trees may be large, and old trees may be small.
Old trees	Yes	Trees develop unique structural characteristics when old (e.g., dead tops, flattened crowns, branching characteristics, bark color and texture.
Age variability	No	An important feature in some old-growth forest types. Some forests regenerate episodically (even-aged) with most trees establishing in a few years to a decade, probably in conjunction with wet years and large seed crops, and in concurrence with relatively long intervals between fires. Others may regenerate over decades (uneven-aged).
Snags and large dead and downed fuels	Yes	Snags and large logs are essential for old growth, but forests with more frequent fires may have fewer logs. Densities and sizes of snags and logs vary, depending on forest type, precipitation, and other factors. Snags, logs, and woody debris typically distributed unevenly in landscapes.
Structural variability	Yes	Both vertical and horizontal variability are critical features of old growth. At broader scales, structure can also be characterized by variability within and among patches. Proportions of patches in different developmental stages of forest succession are also important.

Whether or not a feature is essential may depend on scale (clump/gap, stand, or landscape). For example, age variability is likely at a landscape scale, and snags and large dead and downed fuels may not exist in some patches (adapted from Kaufmann and others 2007).

Old-growth allocations are based on current conditions within the project area along with specific management direction found in the Forest Plan (U.S. Forest Service 1986a). Most sites in the project area currently do not fully meet the minimum criteria for old-growth conditions as listed in the current Forest Plan. Vegetation communities with a large tree component is very rare within the project area, making up less than 1.5 percent of the mixed conifer and ponderosa pine ecological response units. At least 20 percent of each forest type must be managed for old-growth characteristics across the entire Lincoln National Forest (U.S. Forest Service 1986a). Table 1-3 shows the old-growth allocations for the Sacramento Ranger District, by forest type, required by the Forest Plan. Fifty-one percent of the mixed conifer forest type, 21 percent of the ponderosa pine forest type, and 22 percent of the pinyon-juniper forest type need to be managed for old-growth characteristics in the Sacramento Ranger District. The mixed conifer forest type exceeds the 20 percent requirement due to the prevalence of Mexican spotted owl and northern goshawk habitat. The pinyon-juniper forest type exceeds the 20 percent requirement due to the Jefferies Canyon inventoried roadless area. Overall, a third of the Sacramento Ranger District needs to be managed to meet the old-growth criteria required by the 1986 Forest Plan.

Table 1-3. Old-Growth Allocation within the Sacramento Ranger District, Summary

Forest Type	Acres within the Sacramento Ranger District	Acres Managed for Old Growth	Percent of District Managed for Old Growth
Mixed Conifer	151,641	77,553	51
Ponderosa Pine	53,620	11,319	21
Pinyon-Juniper	161,668	35,078	22
Total	**366,929**	**123,950**	**34**

The project would be designed to develop old-growth conditions over the long term that would contribute to this Forest Plan standard. All forested habitat was stratified to meet analysis requirements in the Forest Plan for Mexican spotted owl, northern goshawk, and old-growth allocation, as displayed in Table 1-4. The acreages presented in Table 1-3 and Table 1-4 are spatially and temporally dynamic, meaning the locations where old-growth conditions exist may change over time.

Table 1-4. Old-Growth Allocations by Mexican Spotted Owl and Northern Goshawk Habitat

Mexican Spotted Owl and Northern Goshawk Stratification within the South Sacramento Restoration Project (acres)			Old Growth Allocation (acres) Within Sacramento Ranger District	Old Growth Allocation (acres) Within Project Area (percent of old-growth allocat within Sacramento Ranger District)
Mexican spotted owl habitat	Protected Activity Center – Mixed Conifer	36,829	59,031	36,829 (62.4%)
	Protected Activity Center – Ponderosa Pine	4,389	9,161	4,389 (47.9%)
	Protected Activity Center – Pinyon-Juniper	234	5,296	234 (4.4%)
	Protected Activity Center – Non-Forest Habitat	991	not applicable	not applicable
	Recovery Habitat All (Mixed Conifer only)	46,854	–	–
	Recovery Nest/Roost (20% of Recovery Habitat)	9,371	18,522	9,371 (50.6%)
Northern goshawk	Post-fledging Areas – Pine	825	2,158	825 (38.2%)
	Post-fledging Areas – Pinyon-Juniper	56	572	56 (9.8%)
	Foraging – Pine	9,661	0	0
	Foraging – Pinyon-Juniper	16,044	26,466	3,100 (11.7%)
	Post-fledging Areas – Non-Forest	26	N/A	N/A
Total	**Total Forest and Woodland Habitat**	**114,892**	**–**	**–**
	Total Non-Forest Mexican Spotted Owl and Northern Goshawk Habitat	**1,017**	**–**	**–**
	Additional Inventoried Roadless Area: Pinyon-Juniper	**–**	**2,744**	**2,744 (100%)**
	Total Allocated to Old Growth	**–**	**123,950**	**57,548 (46.4%)**

Species Richness and Composition

The establishment, growth, and survival of understory and overstory species are affected by competition for space, light, nutrients, and water. Biophysical conditions, such as soils, temperature, and moisture regimes, also influence the establishment, development, and abundance of under- and overstory plant species. Disturbances (e.g., fire, insects, pathogens, drought, and wind) often interact with biophysical site characteristics to further influence composition and structure of forest ecosystems.

Such disturbances have variable temporal and spatial effects on vegetation depending on their type, frequency, intensity, seasonality, and spatial scale, which collectively define a characteristic disturbance regime of an ecosystem (Reynolds and others 2013).

In ponderosa pine forests, overstories are dominated by ponderosa pine but may occasionally contain other conifer or hardwood species. Herbaceous understories are typically grasses and forbs. At the warm and dry end of the gradient (generally at lower elevations), ponderosa pine forest intergrades with pinyon-juniper or evergreen oak (Quercus spp.) woodlands. In the cool and moist portion of the gradient, Gambel oak is often a component of ponderosa pine forests, and grass and forb understories may include shrubs. Also at the cool and moist end of the gradient, ponderosa pine intergrades with mixed conifer–frequent fire forests where there may be a minor presence of quaking aspen, Douglas-fir, southwestern white pine, white fir, and blue spruce (Picea pungens). Variation in overstory species composition influences forest structure, disturbance types and intensities, tree mortality rates, and the composition and structure of the grass-forb-shrub community (Reynolds and others 2013).

The desired condition is to manage for percent species composition as indicated by local historical evidence (live trees and snags and logs from trees that originated prior to 1880), if available, biophysical site conditions, and other management objectives (e.g., favoring scarce species; enhancing wildlife habitat; promoting resilience to climate change; or achieving other resource objectives, social values, and regulatory requirements).

Canopy Characteristics and Surface Fuels

Canopy bulk density and canopy base height are characteristics used to measure the potential for crown fire. Higher canopy bulk densities mean there are more fuels to burn. With more fuels, fire intensity would increase and allow fire to easily move through the crowns of trees. The canopy base height of a stand is the lowest height above the ground at which there is a sufficient amount of canopy fuel to spread fire vertically into the canopy. The lower the canopy base height, the easier it is for crown fire to initiate (Van Wagner 1977).

Surface fuels include litter, duff, and coarse woody debris greater than 3 inches in diameter.
High surface fuel loading can result in high-severity fire effects because they can smolder in place for long periods, transferring more heat into soils and tree stems.

The desired condition is to have fire function as a natural disturbance within the ecosystem while reducing the risk of compromising human safety, ecosystem function, property, and resource values from high-intensity, stand-replacing wildfire. Over time, conditions would allow managers to use fire to maintain the area as a functioning ecosystem. There is a need to reduce canopy bulk density and raise canopy base height to reduce the potential for crown fire. To reduce the potential for high-severity surface fire, there is a need to maintain surface fuel loadings within the target range and reduce excessive surface fuel loadings in areas adjacent to and within Mexican spotted owl and northern goshawk habitat. Fire would maintain a mosaic of diverse native plant communities in the future.

Fire Regimes and Hazards

Crown fires have the ability to produce 75 to 100 percent mortality in the forested ecological response units by consuming the tree crowns. The potential for crown fire to occur is usually expressed in the wind speed (miles per hour) that is necessary for fires to move fire from crown to crown. This wind speed is referred to as the Crowning Index. Currently, over 60 percent of the mixed conifer–frequent fire forests, mixed conifer with aspen forests, and ponderosa pine forests within the project area have a Crowning Index of less than 20 miles per hour, meaning wind speeds of 20 miles per hour or less would be sufficient to maintain crown fire in certain areas of the forest.

High fire risk exists throughout the project area, including within the wildland–urban interface, Mexican spotted owl habitat, and other areas with critical values at risk (e.g., Sacramento Peak Observatory, communication infrastructure). Risk of canopy fire under current conditions, as expressed by Crowning Index, has greatly increased from the desired conditions. Under the desired conditions, only 14 percent of the forested landscape would be vulnerable to crown fire with wind speeds as low as 20 miles per hour, while an estimated 60 percent of the forested landscape is currently vulnerable to crown fire with wind speeds as low as 20 miles per hour (Table 1-5).

Although past and ongoing fuel treatments have been implemented in or near these high fire risk areas, much of the landscape is still vulnerable to uncharacteristic wildfire effects and the associated post-fire effects such as flooding, increased erosion, weed infestations, and damaged infrastructure. All of the ecological response units are out of balance with the desired conditions (see Table 1-5). The mixed conifer–frequent fire forest is especially out of balance from the desired condition, as seen by the large amount of area susceptible to crown fire at a wind speed of less than 20 miles per hour (see Table 1-5).

Table 1-5. Comparison of Current and Desired Canopy Crowning Index of Forested Ecological Response Units

Ecological Response Unit	Crowning Index (miles per hour [mph] necessary to carry a crown fire)			
	Less than 20 mph	20 to 35 mph	36 to 50 mph	More than 50 mph
Current Conditions (percent of each ecological response unit in the project area within each crowing index category)				
Mixed Conifer with Aspen Forest	65	34	0	0
Mixed Conifer–Frequent Fire Forest	73	22	5	0
Ponderosa Pine Forest	0	53	15	32
Desired Conditions (percent of each ecological response unit in the project area within each crowing index category)				
Mixed Conifer with Aspen Forest	16	57	0	7
Mixed Conifer–Frequent Fire Forest	16	46	37	0
Ponderosa Pine Forest	0	6	5	88

Fire regime condition class is a coarse-scale assessment tool used to determine how much a landscape's fire regime has departed from its historical fire regime. The fire regime condition class has a scale of 1 to 3, with 3 being the most departed and 1 being the least departed. Areas that fall within condition class 1 have fire regimes are within the natural or historical range and are at low risk of losing key ecosystem components. Vegetation attributes (composition and structure) are well intact and functioning properly. Class 2 areas have fire regimes that have been moderately altered and may have departed by one or more return intervals (either increased or decreased). This departure may result in moderate changes in fire and vegetation attributes. Lastly, class 3 areas have fire regimes that are substantially departed by multiple return intervals. Areas in class 3 that experience wildfires have the potential to result in dramatic changes in fire size, fire intensity and severity, and landscape pattern. Overall, this is another tool that can help guide management objectives and set priorities for treatments and can show the urgent need for forest restoration to reduce the high fire hazard risk throughout the project area in order to build sustainability and resilience. All ecological response units within the project area fall within class 2 and 3, as seen in Table 1-6. Table 1-6 summarizes the existing fire regime, forest structure, and fire regime condition class conditions for the project area and highlights the fact that both the mixed conifer–frequent fire and ponderosa pine forest within the project area are all in fire regime condition class 3.

Table 1-6. Fire Regime, Structure, and Fire Regime Condition Class for the Project Area

Forest Type	Fire Regime	Forest Structure	Fire Regime Condition Class (percent in each class)		
			1	2	3
Mixed Conifer with Aspen Forest	Fires are relatively infrequent and tend to be mixed severity at variable intervals (22 to 150 years). Stand-replacing fires tend to be rare.	Even-aged, closed, sometimes patchy	–	81.5	18.5
Mixed Conifer–Frequent Fire	Low-severity surface fires tend to be common (2- to 24-year interval). Mixed-severity fires tend to be less frequent (35- to 200-year interval).	Uneven-aged, grouped, open; Occasional even-aged patches	–	–	100
Ponderosa Pine Forest	Low-severity surface fires tend to be common (2- to 24-year interval). Mixed-severity fires tend to be rare.	Uneven-aged, grouped, open	–	–	100
Pinyon-Juniper Grassland	Low-severity surface fires tend to be common (0- to 35-year interval).	Uneven-aged, grouped, open	–	75	25
Pinyon-Juniper Woodland	Mixed-severity fires tend to be infrequent (35 to 200 years). Stand-replacing fires tend to be rare (interval greater than 200 years).	Even-aged, closed	–	100	–
Mountain Mahogany Mixed Shrubland	Stand-replacing fires tend to be infrequent (35 to 200 years).	Open, late development state	–	100	–
Gambel Oak Shrubland	Stand-replacing fires tend to be infrequent (35 to 200 years).	Open, late development state	–	100	–
Montane/Subalpine Grassland	Stand-replacing fire common (0 to 35 years).	Open, mature grassland	–	–	100

Ecological Response Units

Ecological response units are generally described as vegetative communities. These units represent an ecosystem stratification based on vegetation characteristics that would occur when natural disturbance regimes and biological processes prevail and combine potential vegetation and historical fire regimes to form ecosystem classes useful for landscape assessment (U.S. Forest Service 2014b). Desired conditions for each ecological response unit within the South Sacramento Restoration planning area are based on guidelines provided in General Technical Report GTR-RMRS-310 (Reynolds and others 2013), the Forest Service Southwestern Region desired condition guidance (U.S. Forest Service 2014b), and the 2012 Mexican spotted owl recovery plan (U.S. Fish and Wildlife Service 2012). Figure 1-5. and summarizes the ecological response units within the project area as well as seral and climax species associated with each. Compared with the overall size of the project area, riparian vegetative communities make up a very small amount of the project area, at approximately 500 acres. As a result, riparian communities are encompassed in the ecological response units shown in Table 1-7.

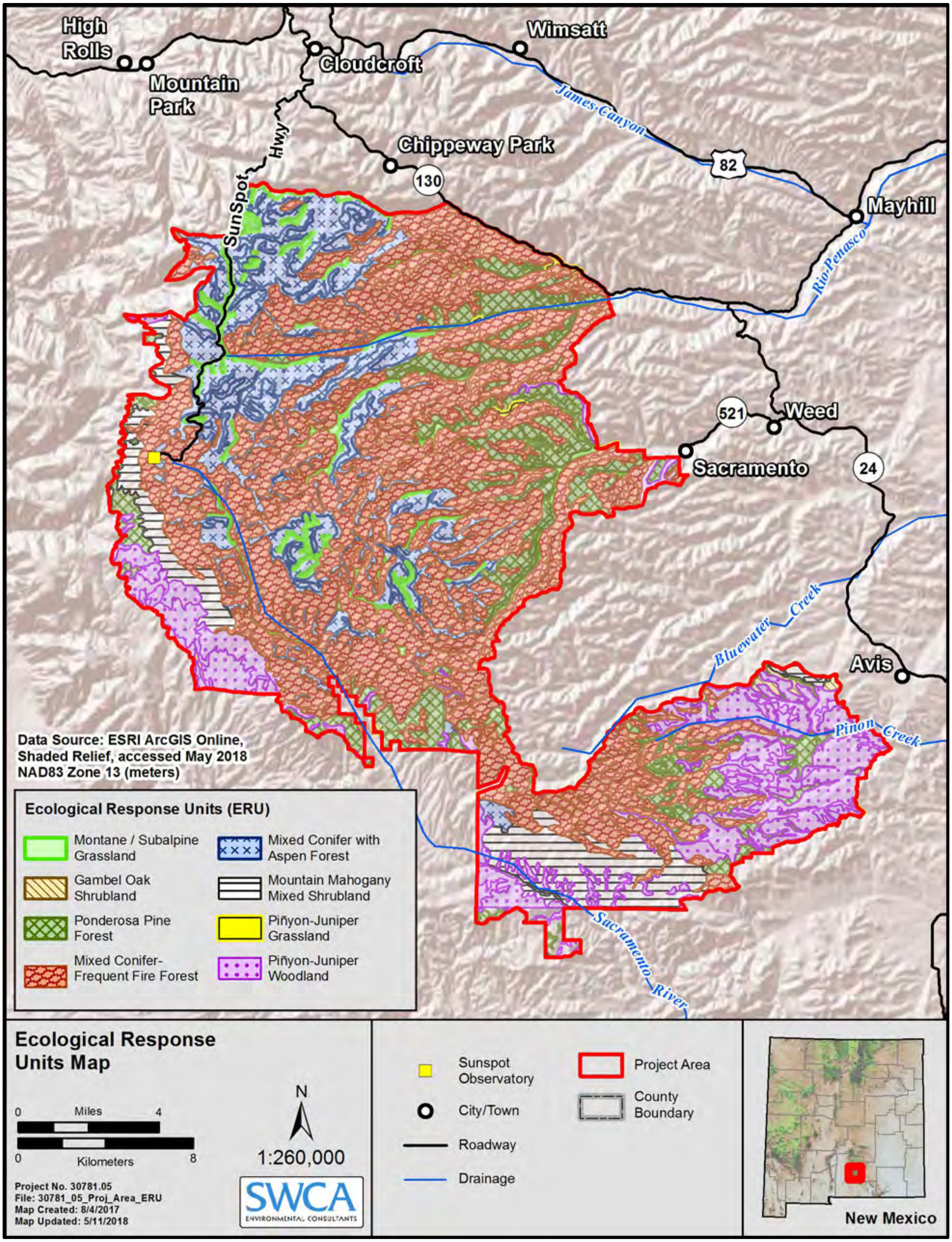

Figure 1-5. Ecological response units within the project area.

Table 1-7. Ecological Response Units, the Associated Seral and Climax Species, and Approximate Acreage in the Project Area

Ecological Response Unit	Seral Species	Climax Species	Portion in Project Area (acres)	Portion in Lincoln National Forest (acres)
Mixed Conifer with Aspen	Dominant: aspen or Douglas-fir, depending upon plant association habitat type	Douglas-fir, white fir, blue spruce, and other shade-tolerant species, depending upon plant association	27,613	35,568
Montane/Subalpine Grassland	Dominant: Kentucky bluegrass, Arizona fescue (*Festuca arizonica),* and mountain brome (*Bromus marginatus*)	Douglas-fir, white fir, blue spruce, Engelmann spruce (*Picea engelmannii*) with less than 10 percent tree cover	4,705	11,230
Mixed Conifer–Frequent Fire Forest	Dominant: ponderosa pine; Subdominant: aspen and/or oak (sub-stand-scale patches)	Ponderosa pine; white fir; and Douglas-fir; southwestern white pine may be subdominant	63,978	163,674
Ponderosa Pine Forest	Dominant: ponderosa pine	Ponderosa pine	17,450	123,156
Pinyon-Juniper Woodland	Dominant: juniper and pinyon pine	Juniper and pinyons and other shade-intolerant species	18,998	319,105
Gambel Oak Shrubland	Dominant Gambel oak	Gambel oak	1,117	3,589
Pinyon-Juniper Grassland	Dominant: juniper and pinyon pine	Juniper and pinyons and other shade-intolerant species	222	165,432
Mountain Mahogany Mixed Shrubland	Dominant: mountain mahogany (*Cercocarpus montanus*)	Mountain mahogany and other shrub species	6,088	52,528

Mixed Conifer with Aspen Forest Communities

The mixed conifer with aspen forest vegetation community generally occurs at elevations ranging from approximately 6,500 to 10,000 feet. Tree species composition varies depending on seral stage, elevation, and moisture availability. It can be composed of early- and mid-seral species such as aspen, Douglas-fir, New Mexico locust (*Robinia neomexicana*), and southwestern white pine, and late-seral species such as maple, white fir, and blue spruce. Ponderosa pine may be present in minor proportions. Disturbances typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly fire), and small-scale frequent disturbances (fire, insect, disease, wind). This forest type has an understory of a wide variety of shrubs, grasses, and forbs, depending on soil type, aspect, elevation, disturbance, and other factors.

<u>Mixed Conifer with Aspen Forest: Key Landscape-Scale Management Elements</u>

- The mixed conifer with aspen forest vegetation community is a mosaic of structural and seral stages, ranging from young trees through old. The landscape arrangement is an assemblage of variably sized and aged patches of trees and other vegetation associations, similar to historical patterns. Tree patches have variable species composition, depending on forest seral stages. Patch sizes vary but are frequently in the hundreds of acres, with rare disturbances in the thousands of acres. Seral state proportions, in accordance with the R3 Seral State Proportions Supplement, are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of good ecosystem condition (Wahlberg and others 2014). Canopies are generally more closed than in frequent-fire mixed conifer forest. An understory consisting of native grass, forbs, and/or shrubs is present. At the Plan unit scale, overall plant composition similarity to site potential averages greater than 66 percent, but can vary considerably at fine and mid-scales, owing to a diversity of seral conditions (Turner and others 2018).

- Old growth generally occurs over large areas as stands. Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- The mixed conifer with aspen forest vegetation community is composed predominantly of vigorous trees, but older, declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris, all well distributed throughout the landscape. The number of snags and the amount of downed logs (greater than 12 inches in diameter at midpoint and greater than 8 feet long) and coarse woody debris (greater than 3 inches in diameter) vary by seral stage.
- Vegetative conditions (composition, structure, and function) are broadly resilient to disturbances of varying frequency, extent, and severity. The forest landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g., insects, diseases, wind, and fire), including snags, downed logs, and old trees. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and ecosystem function. Mixed-severity fire (Fire Regime III) is characteristic, especially at lower elevations of this type. High-severity fires (Fire Regimes IV and V) rarely occur and are typically at higher elevations of this type. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

<u>Mixed Conifer with Aspen Forest: Key Mid-Scale Management Elements</u>

- The size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Groups and patches of tens of acres or less are relatively common. A mosaic of groups and patches of trees, primarily even-aged, and variable in size, species composition, and age, is present. Openness and prevalence of some species (e.g., aspen) is dependent on seral stages. Grass, forb, shrub openings created by disturbance, may comprise 10 to 100 percent of the mid-scale area depending on the disturbances and on time since disturbance. Aspen is occasionally present in large patches. Density ranges from 20 to 180 or greater square foot basal area per acre based upon age and site productivity, and depending upon time since disturbance and seral stages of groups and patches. Snags 18 inches or greater diameter at breast height (DBH) range from one to five snags per acre, with the lower range of snags of this size associated with early-seral stages and the upper range associated with late-seral stages. Snag density in general (greater than 8 inches DBH) averages 20 per acre. Coarse woody debris, including downed logs, varies by seral stage, with averages ranging from 5 to 20 tons per acre for early-seral stages; 20 to 40 tons per acre for mid-seral stages; and 35 tons per acre or greater for late-seral stages.
- Fire severity is mixed or high, with a fire return interval of 35 to 200 or more years (Fire Regimes III, IV, and V). Fires and other disturbances maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. During moister conditions, fires exhibit smoldering low-intensity surface behavior with single tree and isolated group torching. Under drier conditions, fires exhibit passive to active crown fire behavior with conifer tree mortality up to 100 percent across mid-scale patches. High-severity fires generally do not exceed 1,000-acre patches of mortality. Other smaller disturbances occur more frequently. Ground cover consists of shrubs, perennial grasses, and forbs, with basal vegetation values ranging between about 5 and 20 percent depending on the Terrestrial Ecological Unit Inventory unit (U.S. Forest Service 1986a, 2006).

- Forest conditions in northern goshawk post-fledging family areas are similar to general forest conditions, except these forests typically contain 10 percent or greater tree density (basal area) relative to post-fledging family areas than northern goshawk foraging areas and the general forest. Nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the mixed conifer with aspen forest type.

Mixed Conifer with Aspen Forest: Key Fine-Scale Management Elements

- In mid-aged and older forests, trees are typically variably spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking. Trees within groups can be of similar or variable species and ages. Small openings are present as a result of disturbances.
- Organic ground cover and herbaceous vegetation provide protection for soil and moisture infiltration, and contribute to plant diversity and ecosystem function. Due to presence of ladder fuels, fires usually burn either with low intensity, smoldering combustion, or transition rapidly in the canopy as passive or active crown fire.

Montane/Subalpine Grassland

Montane/Subalpine grassland vegetation generally occurs between 8,000 and 10,000 feet and often harbors several plant associations with varying dominant grasses and herbaceous species. Such dominant species may include Arizona fescue (*Festuca arizonica*), pine dropseed (*Blepharoneuron tricholepis*), Kentucky bluegrass, and various sedges (*Carex* spp.)

Trees may occur along the periphery of the meadows, which may include Engelmann spruce (*Picea engelmannii*), blue spruce, Douglas-fir, white fir, and southwestern white pine. Some shrubs may also be present. These meadows are seasonally wet, which is closely tied to snowmelt, though they typically do not experience flooding events.

Montane/Subalpine Grassland: Key Landscape-Scale Management Elements

- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances (e.g., insects, diseases, and fire), and climate variability. Insects and disease occur at endemic levels. Fire as a disturbance is less frequent and variable due to differences in ground cover, though some sites are capable of carrying surface fire. The fires that do occur are mixed to high severity (Fire Regime II). Seral state proportions, per the R3 Seral State Proportions Supplement, are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition (Wahlberg and others 2014).

Montane/Subalpine Grassland: Key Fine-Scale Management Elements

- There are no Forest Service, Southwestern Region fine-scale management elements for Montane/Subalpine Grassland communities. Management objectives would follow the landscape-scale elements for this ecological response unit as the unit is fairly homogenous for all scales.

Mixed Conifer–Frequent Fire Forest Communities

The mixed conifer–frequent fire forest vegetation community is transitional with increasing elevation between ponderosa pine and mixed conifer with aspen forests and generally occurs at elevations ranging from approximately 7,000 to 9,500 feet. Mixed conifer–frequent fire forests are dominated by mainly shade-intolerant trees such as ponderosa pine, southwestern white pine, quaking aspen, and Gambel oak, with a lesser presence of shade-tolerant species such as white fir and blue spruce. Mid-tolerant species such as Douglas-fir are common. Aspen may occur as individual trees or small groups. This forest vegetation community typically occurs with an understory of grasses, forbs, and shrubs.

Mixed Conifer–Frequent Fire Forest: Key Landscape-Scale Management Elements

- The mixed conifer–frequent fire forest vegetation community is a mosaic of forest conditions composed of structural stages ranging from young to old trees. Forest appearance is variable but generally uneven-aged and open; occasional patches of even-aged structure are present.
- The forest is arranged in small clumps and groups of trees interspersed within variably sized openings of grass/forb/shrub vegetation associations similar to historic patterns. Openness typically ranges from 10 percent in more productive sites to 50 percent in the less productive sites. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. Denser tree conditions exist in some locations such as north-facing slopes and canyon bottoms.
- Where they naturally occur, groups of aspen and all structural stages of oak are present.
- Seral state proportions, per the R3 Seral State Proportions Supplement, are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition (Wahlberg and others 2014).
- Old growth occurs throughout the landscape, generally in small areas as individual old-growth components, or as clumps of old growth. Old-growth components include old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- The mixed conifer–frequent fire forest vegetation community is predominantly composed of vigorous trees, but declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris, all well-distributed throughout the landscape. Snags are typically 18 inches or greater at DBH and average three snags per acre. Smaller snags, 8 inches and above at DBH, average eight snags per acre. Downed logs (at least 12 inches in diameter at mid-point, and at least 8 feet long) average three logs per acre within forested areas. Coarse woody debris, including downed logs, ranges from 5 to 15 tons per acre.
- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, severity of disturbances, and to climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g., insects, diseases, fire, and wind), including snags, downed logs, and old trees. Grasses, forbs, shrubs, needle cast (fine fuels), and small trees maintain the natural fire regime. Organic ground cover (leaf litter/needle cast, etc.) and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function.
- At the Plan unit scale, overall plant composition similarity to site potential averages greater than 66 percent, but can vary considerably at fine- and mid-scales owing to a diversity of seral conditions. Frequent, low-severity fires (Fire Regime I) are characteristic, including throughout northern goshawk home ranges. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling (Turner and others 2018).

Mixed Conifer–Frequent Fire Forest: Key Mid-Scale Management Elements

- The mixed conifer–frequent fire forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area.

- Openness typically ranges from 10 percent in more productive sites to 50 percent in the less productive sites. Tree density within forested areas generally ranges from 30 to 100 square foot basal area per acre.
- The mosaic of tree groups generally comprises an uneven-aged forest with all age classes and structural stages. Occasionally small patches (generally less than 50 acres) of even-aged forest structure are present. Disturbances sustain the overall age and structural distribution.
- Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal vegetation values ranging between about 5 and 20 percent depending on the Terrestrial Ecological Unit Inventory unit (U.S. Forest Service 1986a, 2006). Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.
- Forest conditions in northern goshawk post-fledging family areas are similar to general forest conditions except these forests contain 10 to 20 percent higher basal area in mid- to old-age tree groups than in northern goshawk foraging areas and in the general forest. Northern goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the mixed conifer–frequent fire forest type.

Mixed Conifer–Frequent Fire Forest: Key Fine-Scale Management Elements

- Trees typically occur in irregularly shaped groups and are variably spaced with some tight clumps. Crowns of trees within the mid- to old-age groups are interlocking or nearly interlocking. Interspaces surrounding tree groups are variably shaped and comprise a grass/forb/shrub mix. Some natural openings contain individual trees or snags. Trees within groups are of similar or variable ages and one or more species. Size of tree groups typically is less than 1 acre. Groups at the mid- to old-age stages consist of two to approximately 50 trees per group.

Ponderosa Pine Forest Communities

Ponderosa pine forest communities generally occur at elevations ranging from approximately 6,000 to 9,000 feet. Ponderosa pine is one of the most fire-adapted conifer species in the West, and its resistance to surface fire increases as trees age. Ponderosa pine is the dominant seral and climax tree species in Southwest ponderosa pine forests. Depending on locale, ponderosa pine forests commonly include other species such as oak, juniper, and pinyon. More infrequent species such as aspen, Douglas-fir, white fir, or southwestern white pine may also be present. This forest vegetation community typically occurs with an understory of grasses and forbs, although it sometimes includes shrubs.

Ponderosa Pine: Key Landscape-Scale Management Elements

- The ponderosa pine forest vegetation community is composed of trees from structural stages ranging from young to old. Forest appearance is variable but generally uneven-aged and open; occasional areas of even-aged structure are present. The forest arrangement is in individual trees, small clumps, and groups of trees interspersed within variably sized openings of grass/forbs/shrubs vegetation associations similar to historic patterns. Openness typically ranges from 10 percent in more productive sites to 70 percent in the less productive sites. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. Seral state proportions, per the R3 Seral State Proportions Supplement, are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition (Wahlberg and others 2014). In the Gambel oak subtype, all sizes and ages of oak trees are present. Denser tree conditions exist in some locations such as north-facing slopes and canyon bottoms.
- Old growth occurs throughout the landscape, generally in small areas as individual old-growth components, or as clumps of old growth. Old-growth components include old trees, dead trees

(snags), downed wood (coarse woody debris), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).

- The ponderosa pine forest vegetation community is predominantly composed of vigorous trees, but declining trees are a component and provide for snags, top-killed, lightning- and fire-scarred trees, and coarse woody debris (greater than 3 inches in diameter at midpoint), all well-distributed throughout the landscape. Ponderosa pine snags are typically 18 inches or greater at DBH and average one to two snags per acre. In the Gambel oak subtype, large oak snags (greater than 10 inches DBH) are a well-distributed component. Downed logs (greater than 12 inches in diameter at midpoint and greater than 8 feet long) average three logs per acre within the forested area of the landscape. Coarse woody debris, including downed logs, ranges from 3 to 10 tons per acre.
- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The landscape is a functioning ecosystem that contains all its components, processes, and conditions that result from endemic levels of disturbances (e.g., insects, diseases, fire, and wind), including snags, downed logs, and old trees. Grasses, forbs, shrubs, and needle cast (fine fuels), and small trees maintain the natural fire regime. Organic ground cover and herbaceous vegetation provide protection of soil, moisture infiltration, and contribute to plant and animal diversity and to ecosystem function. At the Plan unit scale, overall plant composition similarity to site potential averages greater than 66 percent, but can vary considerably at fine- and mid-scales owing to a diversity of seral conditions (Turner and others 2018). Frequent, low-severity fires (Fire Regime I) are characteristic in this type, including throughout goshawk home ranges. Natural and anthropogenic disturbances are sufficient to maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.

Ponderosa Pine: Key Mid-Scale Management Elements

- The ponderosa pine forest vegetation community is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area, resulting in less space between groups. Openness typically ranges from 52 percent in more productive sites to 90 percent in less productive sites. In areas with high fine-scale aggregation of trees into groups, mid-scale openness ranges between 78 to 90 percent. Tree density within forested areas generally ranges from 22 to 89 square foot basal area per acre (Reynolds and others 2013). Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal vegetation values ranging between about 5 and 20 percent depending on the Terrestrial Ecological Unit Inventory unit (U.S. Forest Service 1986a, 2006).
- The mosaic of tree groups generally comprises an uneven-aged forest with all age classes present. Infrequently, patches of even-aged forest structure are present. Disturbances sustain the overall age and structural distribution.
- Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.
- Forest conditions in northern goshawk post-fledging family areas are similar to general forest conditions except these forests contain 10 to 20 percent higher basal area in mid- to old-age tree groups than in northern goshawk foraging areas and the general forest. Northern goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than other areas in the ponderosa pine type.

Ponderosa Pine: Key Fine-Scale Management Elements

- Trees typically occur in irregularly shaped groups and are variably spaced with some tight clumps. Crowns of trees within the mid- to old-age groups are interlocking or nearly interlocking. Interspaces surrounding tree groups are variably shaped and comprise a grass/forb/shrub mix. Some natural openings contain individual trees. Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Size of tree groups typically is less than 1 acre, but averages 0.5 acre. Groups at the mid- to old-age stages consist of two to approximately 40 trees per group.

Pinyon-Juniper Communities

Pinyon-juniper vegetation communities generally occur at elevations between approximately 4,500 and 7,500 feet. They are dominated by one or more species of pinyon pine and/or juniper. In the South Sacramento Restoration planning area, pinyon-juniper communities can occur with a grass/forb dominated understory (pinyon-juniper grassland) or a discontinuous understory of some grasses and/or shrubs (pinyon-juniper woodland). Pinyon pine is common. One-seed juniper, Rocky Mountain juniper (*Juniperus scopulorum*), and alligator juniper are common, with a lesser abundance of oaks. Species composition and stand structure vary by location primarily due to precipitation, elevation, temperature, and soil type.

Pinyon-Juniper Grassland: Key Landscape-Scale Management Elements

- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (e.g., insects, diseases, and fire) and climate variability. Fires are typically frequent and low-severity (Fire Regime I). Seral state proportions, per the R3 Seral State Proportions Supplement, are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition (Wahlberg and others 2014).
- Old growth occurs throughout the landscape, generally in small areas as individual old-growth components, or as clumps of old growth. Old-growth components include old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). Snags are scattered across the landscape, with snags 8 inches diameter at root collar (DRC) and above averaging five snags per acre, whereas snags 18 inches and above average one snag per acre (Weisz and others 2010). Coarse woody debris increases with succession and averages 1 to 3 tons per acre. Overall plant composition similarity to site potential averages greater than 66 percent, but can vary considerably at the fine- and mid-scales owing to a diversity of seral conditions (Turner and others 2018).

Pinyon-Juniper Grassland: Key Mid-Scale Management Elements

- Scattered shrubs and a dense herbaceous understory including native grasses, forbs, and annuals are present to support frequent surface fires. Ground cover consists primarily of perennial grasses and forbs capable of carrying surface fire, with basal vegetation values averaging between about 10 and 30 percent depending on the Terrestrial Ecological Unit Inventory unit (U.S. Forest Service 1986a, 2006). Shrubs average less than 30 percent canopy cover.

Pinyon-Juniper Grassland: Key Fine-Scale Management Elements

- Pinyon-juniper grassland and juniper grassland are generally uneven-aged and open in appearance. Trees occur as individuals, but occasionally in smaller groups, and range from young to old. Patch sizes of woodlands range from individual trees and clumps that are less than 0.1 acre, to tree groups of approximately 1 acre (Muldavin and others 2003).

Pinyon-Juniper Woodland: Key Landscape-Scale Management Elements

- Pinyon-juniper woodland (persistent) is characterized by even-aged patches of pinyons and junipers that at the landscape level form multi-aged woodlands.

- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances (e.g., insects, diseases, and fire), and climate variability. Insects and disease occur at endemic levels. Fire as a disturbance is less frequent and variable due to differences in ground cover, though some sites are capable of carrying surface fire. The fires that do occur are mixed to high severity (Fire Regimes III, IV, and V). Seral state proportions, per the R3 Seral State Proportions Supplement, are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition (Wahlberg and others 2014).
- Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity, and is often concentrated in mid- and fine-scale units as patches of old growth. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). Very old trees (greater than 300 years old) are present, whereas snags and older trees with dead limbs and/or tops are scattered across the landscape. Snags 8 inches DRC and above average five snags per acre, while snags 18 inches and above average one snag per acre (Weisz and others 2010). Coarse woody debris increases with succession and averages 2 to 5 tons per acre. Overall plant composition similarity to site potential averages greater than 66 percent, but can vary considerably at fine- and mid-scales owing to a diversity of seral conditions (Turner and others 2018).

Pinyon-Juniper Woodland: Key Mid-Scale Management Elements

- Tree density and canopy cover are high, shrubs are sparse to moderate, and herbaceous cover is low and discontinuous. Ground cover consists of shrubs, perennial grasses, and forbs with basal vegetation values ranging between about 5 and 15 percent depending on the Terrestrial Ecological Unit Inventory unit (U.S. Forest Service 1986a). Trees occur in even-aged patches ranging from young to old, where patch size of these woodlands ranges from tens to hundreds of acres (Muldavin and others 2003).

Pinyon-Juniper Woodland: Key Fine-Scale Management Elements

- There are no Forest Service, Southwestern Region fine-scale management elements for pinyon-juniper woodland communities. Management objectives would follow the mid- and landscape-scale elements for this ecological response unit.

Gambel Oak Shrubland

Gambel oak shrubland is dominated by long-lived Gambel oak clones that form largely mono-typic overstories (Simonin 2000) and generally occurs between 6,500 and 9,500 feet on all aspects, although at higher elevations it occurs more predominantly on southern exposures. Gambel oak occurs as the dominant species ranging from dense thickets to clumps associated with other shrub species.Older, more developed Gambel oak can have a well-developed understory comprising snowberry (*Symphoricarpos albus laevigatus*), yarrow (*Achillea millefolium*), and goldenrod (*Solidago*). Depending on site potential, ponderosa pine, juniper, and pinyon pine can encroach on older plant communities. The primary disturbance mechanism is mixed-severity to stand-replacing fire resulting in top-kill and rare mortality. Gambel oak responds to fire with vigorous sprouting from the root crown. Large forms may survive low-intensity surface fire.

Gambel Oak Shrubland: Key Landscape-Scale Management Elements

- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent, and severity of disturbances (e.g., insects, diseases, and fire), and climate variability. Insects and disease occur at endemic levels. Fire as a disturbance is less frequent and variable due to differences in ground cover, though some sites are capable of carrying surface fire. The fires that do occur are mixed to high-severity stand replacing (Fire Regime IV). Seral state proportions, per the R3 Seral State Proportions Supplement, are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition (Wahlberg and others 2014).

- The Gambel Oak Shrubland ecological response unit is classified by the Southwestern Region Terrestrial Ecological Unit Inventory as an edaphic-fire disclimax (a relatively stable community that is not the climax community for the site, but is maintained by fire disturbance). On contemporary landscapes, in the absence of recurring mixed to stand-replacing fire, coniferous tree species may be co-dominant to dominant (U.S. Forest Service 2014b).

Gambel Oak Shrubland: Key Fine-Scale Management Elements

- There are no Forest Service, Southwestern Region fine-scale management elements for Gambel Oak Shrubland communities. Management objectives would follow the landscape-scale elements for this ecological response unit as the unit is fairly homogenous for all scales.

Mountain Mahogany Mixed Shrubland

Mountain mahogany mixed shrubland vegetation generally occurs in foothills, canyon slopes, and lower mountain slopes. These shrublands are often associated with exposed sites, rocky substrates, dry conditions, and recurrent historic fire that limited tree growth. Scattered trees or inclusions of grassland patches may be present, but sites are typically dominated by mountain mahogany (*Cercocarpus montanus*) and skunkbush sumac (*Rhus trilobata*).

Mountain Mahogany Mixed Shrubland Key Landscape-Scale Management Elements

- The composition, structure, and function of vegetative conditions are resilient to the frequency, extent and severity of disturbances (e.g., insects, diseases, and fire), and climate variability. Insects and disease occur at endemic levels. Fire as a disturbance is less frequent and variable due to differences in ground cover, though some sites are capable of carrying surface fire. The fires that do occur are mixed to high severity (Fire Regime IV). Seral state proportions, per the R3 Seral State Proportions Supplement, are applied at the landscape scale, where low overall departure from reference proportions is a positive indicator of ecosystem condition (Wahlberg and others 2014).

Mountain Mahogany Mixed Shrubland: Key Fine-Scale Management Elements

- There are no Forest Service, Southwestern Region fine-scale management elements for Mountain Mahogany Mixed Shrubland communities. Management objectives would follow the mid- and landscape-scale elements for this ecological response unit.

Mexican Spotted Owl Habitat

The project area lies with the Basin and Range East ecological management unit for the Mexican spotted owl. Ecological management units are geographical subdivisions of the owl range established by the U.S. Fish and Wildlife Service to organize owl recovery efforts. Recovery habitat is defined as Mexican spotted owl habitat outside of protected activity centers occurring in mixed conifer, ponderosa pine-oak, riparian forests, and/or rocky canyons. Figure 1-6 shows the Mexican spotted owl protected activity centers within the South Sacramento Restoration Project area. Forested recovery habitat includes mixed conifer and pine-oak forests outside of protected activity centers. Mixed conifer forest is the primary habitat type used by Mexican spotted owl in the project area for nesting, roosting, foraging, dispersal, and/or other life history needs. Ponderosa pine forest and other habitats, such as pinyon-juniper, are used for foraging, dispersal, and wintering. Mixed conifer is used by the Mexican spotted owl for all activities. Although there is approximately 500 acres of riparian habitat within the project area, there is

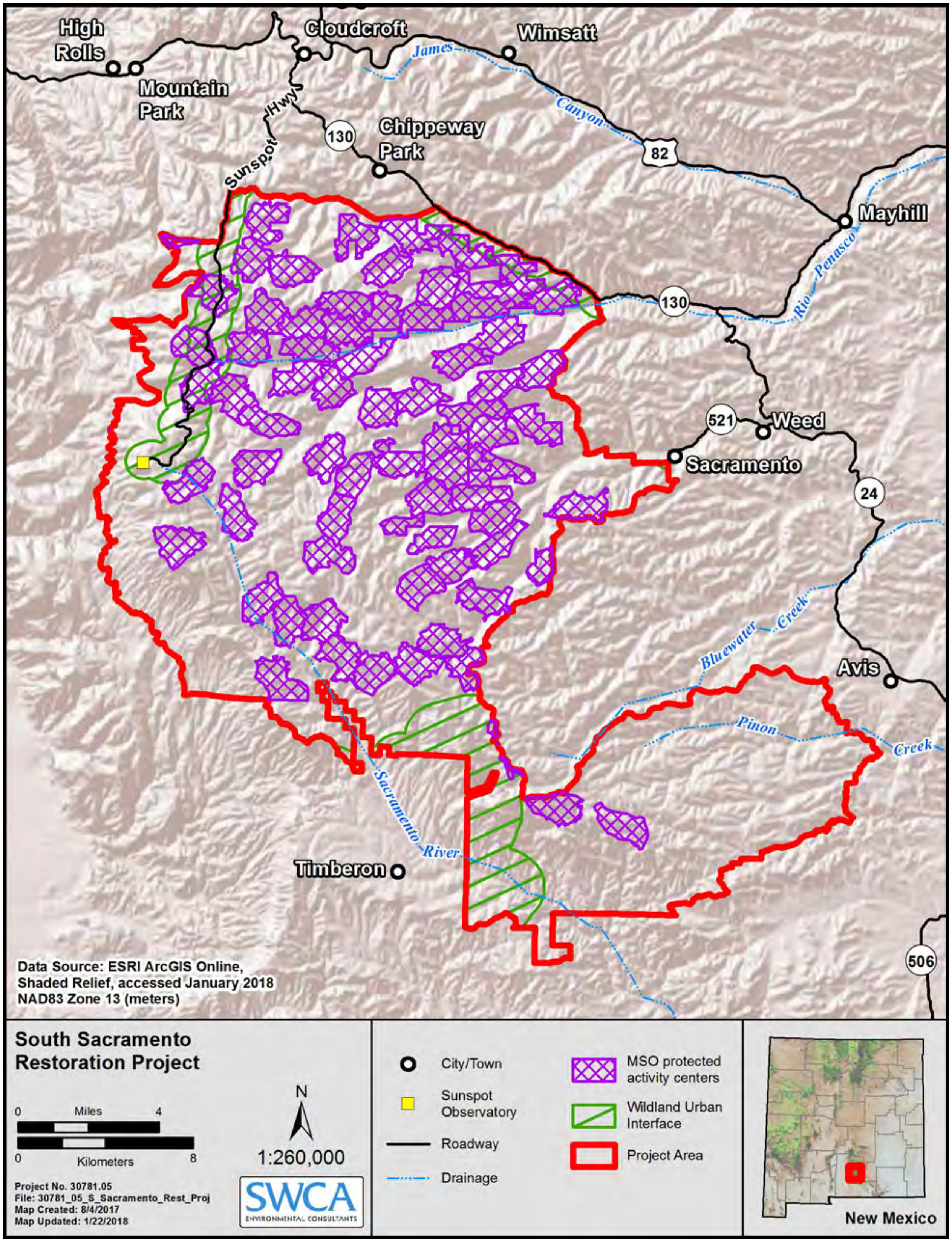

Figure 1-6. Mexican spotted owl protected activity centers and wildland–urban interface within South Sacramento Restoration Project area.

no riparian recovery habitat for the Mexican spotted owl within the project area, as defined by the Mexican spotted owl recovery plan (U.S. Fish and Wildlife Service 2012).

Recovery nest/roost habitat either currently is suitable or has the potential to develop into suitable nest/roost habitat. This habitat should be managed to maintain or to replace nest/roost habitat lost due to disturbance or senescence and to provide additional nest/roost habitat to facilitate recovery of the owl and greater dispersal of owl populations. Forested non-nest/roost recovery habitat that does not have potential to serve as nest/roost habitat should be managed for other life history needs (such as foraging, dispersing, or wintering) provided that key habitat elements are retained across the landscape.

Mexican spotted owl habitat in the project area is at risk of high-severity wildfires and density-related mortality. There is a need to improve habitat resiliency by reducing the potential for these disturbances in protected activity centers and recovery habitat. Development of future habitat in forest stands that are not currently suitable for nesting and roosting or only provide marginal habitat is also desirable.

Uneven-aged management strategies are needed to improve nesting and roosting habitat and reduce the potential loss of habitat. Existing, late-seral stands would be maintained or restored where necessary across the landscape. Management practices should favor uneven-aged management with an emphasis on retaining or promoting the development of large trees; retaining large hardwoods and large snags of all species; developing spatial heterogeneity; and managing for species diversity.

Desired Conditions for Protected Activity Centers

The following minimum parameters have been established within nest cores in established protected activity centers:

- Stands should have a minimum basal area of 145 square feet per acre and a minimum density of 15 trees per acre in the greater than 18-inch DBH size class;
- Maintain a minimum of 60 percent canopy cover in mixed conifer;
- Trees in the 12- to 18-inch DBH size class should comprise at least 30 percent of stand basal area. Trees in the greater than 18-inch DBH size class should comprise at least 30 percent of stand basal area; and
- Retain dead and down woody material and snags per current recovery plan guidelines.

The following minimum parameters have been established outside of nest cores in established protected activity centers:

- Strive for tree species diversity, especially with a mixture of hardwoods and shade-tolerant species, to be improved and maintained
- Strive for diverse composition of vigorous native herbaceous and shrub species to be improved and maintained
- Emphasize the retention of large hardwoods
- Maintain a minimum of 60 percent canopy cover in mixed conifer forest. Pure ponderosa pine stands would be managed to appropriate canopy cover requirements. Canopy cover would be managed within stands.
- Trees greater than 16 inches DBH would contribute at least 50 percent of the stand basal area
- Opening sizes would vary between 0.1 and 2.5 acres. Openings within a forest are different than natural meadows. Small canopy gaps within forested patches provide for prey habitat diversity. Openings should be small in nest/roost core areas, may be larger in rest of protected activity

center. Two to five tree clumps will be retained in openings. The shape of the openings should fall along natural features and look as natural as possible.

- Create a diversity of patch sizes with minimum patch size of 2.5 acres with larger patches near activity center; mix of sizes towards periphery. Forest type may dictate patch size (i.e., mixed conifer forests have larger and fewer patches than pine-oak forest). Strive for between-patch heterogeneity.
- Strive for horizontal and vertical habitat heterogeneity within patches, including tree species composition.
- Trees greater than 18 inches DBH should not be removed unless there are compelling safety reasons to do so or if it can be demonstrated that removal of these trees would benefit owl habitat. This should be done judiciously and only when truly necessary to meet specific resource objectives.
- Retain dead and downed woody material and snags per current recovery plan guidelines.

Desired Conditions for Recovery Nest/Roost Replacement Habitat

The following minimum parameters have been established to promote the retention or development of suitable recovery nest/roost habitat (outside of established protected activity centers):

- Identify forested stands that currently meet or exceed owl nest/roost conditions or where such conditions can be reasonably obtained in time.
- No stands currently meeting nest/roost conditions would be treated in such a way as to lower that stand below those conditions unless a surplus of these stands exists at a larger landscape level (e.g., no less than the size of the Sacramento Ranger District).
- Strive for tree species diversity, especially with a mixture of hardwoods and shade-tolerant species, to be improved and maintained.
- Strive for diverse composition of vigorous native herbaceous and shrub species to be improved and maintained.
- Emphasize the retention of large hardwoods.
- Strive for a diversity of patch sizes with minimum contiguous patch size of 1.0 to 2.5 acres. Forest type may dictate patch size (i.e., mixed conifer forests have larger and fewer patches than pine-oak forest). Strive for between-patch heterogeneity.
- Strive for horizontal and vertical habitat heterogeneity within patches, including tree species composition.
- Opening sizes would vary between 0.1 to 0.5 acres. Openings within a forest are different than natural meadows. Small canopy gaps within forested patches provide for prey habitat diversity. Openings should be small in nest/roost patches, may be larger in rest of protected activity center. A tree clump would be retained in larger openings. The shape of the openings should fall along natural features and look as natural as possible.
- Maintain a minimum of 60 percent canopy cover in mixed conifer forest.
- A diversity of tree sizes with trees 16 inches DBH or larger contributing to at least 50 percent of the basal area of a stand.
- Trees greater than 18 inches DBH should not be removed unless there are compelling safety reasons to do so or if it can be demonstrated that removal of those areas would enhance owl habitat. This should be done judiciously and only when truly necessary to meet specific resource objectives.

- Retain 10 to 15 tons per acre of downed logs at 12 inches midpoint at least 8 feet long unless this conflicts with forest restoration and/or owl habitat.
- Retain dead and down woody material and snags per current recovery plan guidelines.

Desired Conditions for Forested Recovery Habitat (Non-Nest/Roost)

The following minimum parameters have been established in this unit to promote the retention or development of forested recovery habitat that is suitable for foraging, dispersal, and wintering (outside of established protected activity centers):

- Strive for spatial heterogeneity by incorporating natural variation, such as irregular tree spacing and various stand/patch/group/clump sizes.
- Emphasize the retention of large hardwoods.
- Retain most trees greater than 18 inches DBH when possible and strive to retain (do not cut) all trees greater than 24 inches DBH, unless overriding management situations require their removal to protect human safety and/or property (e.g., the removal of hazard trees along roads, in campgrounds, and along power lines).
- Retain the five largest snags per acre with an emphasis of greater than 18 inches DBH unless overriding management situations require their removal to protect human safety and/or property (e.g., the removal of hazard trees along roads, in campgrounds, and along power lines).
- Retain 10 to 15 tons per acre of downed logs at 12 inches midpoint at least 8 feet long unless this conflicts with forest restoration and/or owl habitat.
- Retain dead and down woody material and snags per current recovery plan guidelines.

Mexican Spotted Owl Critical Habitat

The U.S. Fish and Wildlife Service (2005) identified primary constituent elements in the August 2004 designation of Mexican spotted owl critical habitat. Primary constituent elements are those physical and biological features necessary to ensure conservation of the species. Critical habitat includes only protected and restricted habitats as defined in the original recovery plan (U.S. Fish and Wildlife Service 1995). The primary constituent elements of critical habitat include habitat features recognized as being associated with Mexican spotted owl occupancy. The following parameters, designed to promote an uneven-aged forest structure and provide for adequate prey species, would also be followed within designated critical habitat:

- A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees. Trees greater than 12 inches DBH would comprise 30 to 45 percent of a stand;
- maintain a minimum of 40 percent canopy cover;
- maintain snags greater than 12 inches DBH;
- maintain high volumes of fallen trees and other woody debris;
- maintain a wide range of tree and plant species, including hardwoods; and
- maintain adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration.

Northern Goshawk Habitat

Ponderosa pine forest is the primary habitat type used by northern goshawks, although mixed conifer and other habitat types may be used as well. Established post-fledgling family areas and nest areas in the project area are at risk of high-severity wildfires and density-related mortality. There is a need to improve habitat resiliency by reducing the potential for these disturbances within established habitat. Uneven-aged management strategies are needed to improve nesting and roosting habitat and reduce the potential loss of habitat. Existing, late-seral stands would be maintained or restored where necessary across the landscape. Management practices should favor uneven-aged management with an emphasis on retaining or promoting the development of large trees; retaining large snags; developing spatial heterogeneity; and managing for species diversity.

The desired conditions described for old growth and for the ponderosa pine, mixed conifer, and pinyon-juniper ecological response units are expected to promote the development of suitable northern goshawk habitat. Within established post-fledgling family areas, however, the following modifications would apply per Forest Plan direction:

- Within mid-aged ponderosa pine forest (vegetation structural stage 4), maintain a minimum of 60 percent canopy cover in one-third of stands and a minimum of 50 percent canopy cover in two-thirds of stands. Within mature and old ponderosa pine forest (vegetation structural stages 5 and 6), maintain a minimum of 60 percent canopy cover in all stands;
- within mid-age to old mixed confer forest (vegetation structural stages 4 to 6), maintain a minimum of 60 percent canopy cover;
- within pinyon-juniper woodlands, maintain existing canopy cover; and
- in nest areas, promote the development of the mature and old forest stages to have a canopy cover between 50 and 70 percent. Maintain a minimum basal area of 70 square feet per acre.

Desired conditions for prey habitat within post-fledgling family areas include (Reynolds and others 1992):

- large trees (greater than 18 inches DBH) for feeding and/or nesting tree squirrels;
- large snags and/or trees with exposed heartwood (greater than 18 inches DBH and greater than 30 feet tall) for nest cavity excavation by woodpeckers;
- patches of mid-aged forests with high canopy cover (up to 70 percent) that provide mesic conditions for fungi (important foods for all the mammalian prey);
- small (less than 2-acre) openings in the tree canopy to produce herbaceous and shrubby foods for the herbivorous prey;
- large (greater than 12 inches in diameter and greater than 8 feet long) downed logs and other woody debris that provide hiding, feeding, denning, and nesting sites used by goshawk prey; and
- an intermixture of forest conditions intermediate between the high foliage volume and canopy cover of the nest stands and the more open foraging habitats.

Northern goshawk and Mexican spotted owl habitats overlap in the project area. Wherever Mexican spotted owl habitat overlaps with northern goshawk habitat, desired conditions and guidelines for the Mexican spotted owl will take precedence when guidelines for the two species are not aligned.

Wildland–Urban Interface

There are two wildland–urban interface zones identified for the South Sacramento Restoration Project area. Desired conditions in the wildland–urban interface include conditions where wildland fires would result in no loss of life, property, or characteristic ecosystem function. Firefighters would be able to safely and efficiently manage wildfires.

- Where the wildland–urban interface intersects vegetation types with a mixed or high-severity fire regime, characteristic ecosystem function is modified to promote low-intensity surface fires. Ladder fuels are nearly absent.
- In forested vegetation communities, trees within groups may be more widely spaced with less interlocking of the crowns and larger interspace of grass/forb/shrub vegetation than desirable in adjacent forest lands. Interspaces between tree groups are of sufficient size to discourage isolated group torching from spreading as a crown fire to other groups. The tree basal area in the wildland–urban interface is on the lower end of the range given in the vegetation community desired conditions.
- Logs and snags, which often pose fire control problems, are present in the wildland–urban interface, but at the lower end of the range given in the appropriate vegetation community desired conditions. Dead and down fuel load is light, even in vegetation types with higher reference fuel loads, such as mixed conifer with aspen forest, to provide improved fire protection to human developments deemed to have special significance. Higher fuel loading or tree densities may occur in areas where it provides for important fine-scale habitat structure, as long as it meets the overall intent of protecting values at risk.
- Sites occupied by buildings, telecommunication facilities, and similar structures would be treated to provide a sufficient defensible space around these structures from a wildland fire. Individual trees that are determined to contribute to wildfire risk or pose a hazard to these sites would be removed. The remainder of the sites would be reduced to approximately 20 to 40 square feet basal area per acre with the purpose of raising the crown base height and leaving the largest and most fire-resistant trees.

Soil Conditions

Stands in the project area predominantly have a closed stand structure, with high canopy covers and densities. This has reduced understory forage productivity, although there is generally sufficient vegetative ground cover to reduce accelerated erosion. Due to the closed stand structure, most soils and strata are at risk from the relatively high potential for crown fire. Crown fires typically result in moderate to high burn severity effects on the watershed functioning. Fires which burn at a moderate or high severity have the potential to increase the risk to soils, watershed function, and downstream water quality through the increase of erosion following storm events.

The desired condition is to protect long-term soil productivity by maintaining satisfactory soil conditions where it is presently in good condition and improving soil condition and function where soils are currently impaired. Vegetative ground cover would be adequate to maintain soil stability and the soils would have enough nutrients to maintain vegetative productivity. Soil loss would be minimized across the project area, with no visible signs of excessive erosion. Surface soil hydrologic function would be in satisfactory condition being well aggregated and having sufficient permeability to allow for effective infiltration of water into the soil and percolation down to the groundwater. Soil nutrient cycling would be in satisfactory condition.

Hydrology

Watersheds would exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition. Watershed function would be at or moving toward satisfactory and properly functioning conditions. Vegetative structure, soil condition, species diversity and ecosystem resiliency to wildfire, flooding, drought, and other stressors would align with parameters previously described. Watersheds would contain the proper abundance and diversity of native vegetation that would stabilize the soils, help reduce overland flow, and increase infiltration rates and soil water-holding capacity. This would result in a decrease of accelerated hillslope erosion, rill formation, headcut formation, and down-cutting of stream channels.

Intermittent and ephemeral streams are found throughout the project area and play an important role in the health of a watershed. An intermittent channel is defined as having flowing water during the wet season but is normally dry during hot summer months and during extended periods of drought. Intermittent streams do not have continuous flowing water year-round and are not permanent water but are important for hydrological function of watersheds and provide important seasonal habitat for a variety of wildlife. Ephemeral streams have less flow than intermittent streams, are typically shallow, and have flowing water for brief periods in response to precipitation. The desired condition is to restore the functionality of intermittent and ephemeral streams by promoting vegetative growth of woody and herbaceous native species, reducing tree encroachment in meadow areas and along stream channels, reduce nonnative invasive plants, and increase resiliency to potential future disturbances. It is expected that restored streams would be able to convey water during high precipitation events without accelerated channel deepening, headcut formation, or excess erosion.

Social and Economic Conditions

The communities surrounding the project area rely upon the forest to provide a variety of benefits and services, including clean air and water, and access to a variety of forest uses and products. By ensuring resilient ecosystems, the Forest Service can help to sustain local economic and social well-being, promote a sustainable flow of societal benefits, and manage multiple uses over the long term, so that these lands provide enduring ecosystem services and contribute to social and economic stability as well.

The Forest Service recognizes there are socioeconomic challenges associated with restoration management, including access, forest product industry capacity, economic viability, and public perceptions and understanding of forest ecosystems and restoration objectives.

Timber and forest products industries are a key partner for restoring forest ecosystems, and they also contribute to the economic balance of local surrounding communities. While sawmills and other timber industries surrounding the Lincoln National Forest have diminished over the decades, technological advances have created new opportunities to use a variety of forest products, including small-diameter trees. The feasibility of these opportunities depends on forest products industry capacity, economic viability, and market demand.

Given the interdependent relationship between community sustainability and forest sustainability, the Lincoln National Forest will:

- coordinate with local communities, government agencies, outfitter guides, range allotment permittees, adjacent landowners, conservation organizations, and the general public to design and implement the South Sacramento Restoration Project;
- articulate restoration management objectives in education and interpretive products, programs, and public contacts;
- support the needs and demand for forest product offerings in a sustainable manner that promotes ecosystem function, resilience, and sustainability;
- support economic development in local communities by making available a diverse supply of wood (i.e., quantity, size, species, and quality) capable of sustaining local forest product industries and meeting demands for local fuelwood collection;

- support innovative wood utilization, such as converting cut-tree mass into biofuels, pellets, biochar, and other emerging wood utilization markets;
- utilize a combination of legal authorities and partnerships to broaden opportunities for meeting forest restoration objectives with cost-effective treatments and timber contracts; and
- anticipate climate-related plant succession changes (such as favoring heat- or drought-resistant tree species as leave trees, or in reforestation) when designing restoration treatments.

1.5 Proposed Action

The proposed action is designed to provide a wide range of restoration methods that could be used to achieve desired conditions at the fine scale, mid-scale, and landscape scale. Each restoration method has a related set of tools that may be used on any given location, depending on the characteristics of the specific treatment site, such as vegetation type, topography, presence of federally listed species, etc. This approach provides flexibility and is known as the “toolbox” approach. The Forest Service would apply the most appropriate tool or combination of tools to achieve desired results. Before carrying out treatments, project leaders would carefully look at the specific area to be treated and select the appropriate treatment tool(s) using an integrated resource process. The tools that may be considered as well as the circumstances under which they may be applied are described in detail in the following sections. Table 1-8 provides a general overview of the restoration methods and associated tools that could be used to implement the proposed project.

Chapter 2 provides a detailed discussion of the various elements of the proposed action summarized below.

Table 1-8. Summary of Restoration Methods and Associated Activities that Comprise the Proposed Action, with Acreage

Restoration Method/Associated Activities	Tools to Be Used for Implementation	Approximate Acres or Miles of each Activity
<u>Vegetation Thinning</u> Free Thinning of all Tree Sizes Thin from Below Group Selection with Matrix Thinning between Groups	Hand thinning Mechanical whole tree Manual harvesting Cut to length Skyline yarding Machine piling Mastication	53,910 acres
<u>Use of Fire</u> Prescribed Fire Management of Wildfire to Meet Multiple Objectives	Broadcast burning Pile burning Jackpot burning Mobile incinerators	108,120 acres
Herbicide Applications	Daubing or wicking and wiping Foliar application Basal bark Frill or hack and squirt Cut-stump	Within the 140,000-acre project area to control oak and juniper resprouts
<u>Other Restoration Methods</u> Site Rehabilitation and Planting Watershed Improvement and Erosion Control Water Developments Recreation Sites Interpretive Sites	Multiple tools	Within the 140,000-acre project area, where needed

Restoration Method/Associated Activities	Tools to Be Used for Implementation	Approximate Acres or Miles of each Activity
Special Use Authorizations	Potential locations for forest industry activities, such as sorting yards, log processing sites, mobile incinerator sites, etc.	Within the 140,000-acre project area, where siting criteria allow
Road Management	Road construction and reconstruction Road maintenance and relocation Temporary road closures Rehabilitation of unauthorized routes	125 miles of temporary or system roads

Per requirements of the Healthy Forest Restoration Act (Title I, Section 104(f)), the proposed action was developed using a collaborative process that included state and local governments, Native American tribes, and interested individuals and organizations. Best available science was also used to identify desired conditions and in the analysis of the affected resources and potential impacts of implementing the proposed action.

1.6 Decision Framework

The Lincoln National Forest Supervisor must decide whether to approve the South Sacramento Restoration Project on National Forest System lands, and if so, under what terms and conditions, including adaptive management requirements.

To further meet project goals, the proposed action includes a project-specific amendment to the Forest Plan that would authorize the use of restoration strategies in places and under conditions that were not foreseen when the current Forest Plan standards and guidelines were established in 1986. A project-specific plan amendment is a one-time variance in Forest Plan direction. Forest Plan standards and guidelines revert back to the original language for all other ongoing or future projects that may be authorized on the Lincoln National Forest unless additional amendments are made for those other projects. If adopted, this would be the nineteenth amendment to the Forest Plan since its inception in 1986.

Although the current Forest Plan is under revision, we anticipate that the South Sacramento Restoration Project decision will be completed prior to the release of the revised Forest Plan. Therefore, an amendment to the current plan is required for the project to be implemented as described. The project is expected to be consistent with the revised Forest Plan when it is finalized.

The proposed amendment provided in Appendix A does not propose changes in management area boundaries but would modify Forest Plan standards and guidelines so new controls and technologies can be utilized where appropriate.

The proposed changes to the standards and guidelines related to management prescriptions applicable to soil and water (page 40), recreation (replacement page 28), timber (replacement pages 37 and 38), and fire and protection (replacement pages 51 and 55) allow the best practices to be used. The changes to the all species (replacement pages 205 and 206), Mexican spotted owl (replacement pages 206A, 206C, 206D, 206E, 208H, 208I), and northern goshawk (replacement pages 208A, 208C, 208D, 208E) standards and guidelines are not optional. These changes make the project consistent with the management objectives and approved recovery plans and signed conservation agreements and/or other conservation measures identified through Endangered Species Act, Section 7 procedures.

The amendment would follow the 2012 Planning Rule per 36 CFR 219.17 (b)(2). Impacts of the proposed amendment on the substantive 2012 Planning Rule requirements (36 CFR 219.8 through 219.11) are discussed in Appendix A. Impacts of the proposed amendment to resources in the South Sacramento Restoration Project area are discussed in Chapter 3.

As a cooperating agency, the U.S. Fish and Wildlife Service also has a decision to be made related for South Sacramento Restoration Project. Portions of the proposed action could be funded through various grant programs administered by the U.S. Fish and Wildlife Service, Wildlife and Sport Fish Restoration Program.

1.7 Public Involvement and Tribal Consultation

On April 6, 2017, the notice of intent was published in the *Federal Register* announcing the preparation of an environmental impact statement for the proposed action in the Sacramento Ranger District. The published notice of intent initiated the formal 30-day public scoping period, which began April 7 and ended on May 8, 2017.

While the formal scoping comment period started April 7, the Forest Service initiated informal scoping efforts in late February, using a collaborative approach to develop the proposed action. In a letter from the Forest Supervisor mailed and emailed on February 28, 2017, the U.S. Forest Service invited approximately 400 stakeholders to participate in a two-day Collaboration Workshop to discuss preliminary aspects of the project and collaboratively develop and refine the proposed action alternative. The workshop was held on March 15 and 16, 2017, in Cloudcroft, New Mexico, and was attended by 23 participants. Additionally, updates and information about the project have been available for review since March 2017 on the project website under Project Pre-Scoping Documents (https://www.fs.usda.gov/project/?project=51146).

A scoping letter was mailed and emailed by the U.S. Forest Service on April 4, 2017, to approximately 200 stakeholders, including private landowners, agencies, organizations, and tribes to inform the public of the project. The letter included a detailed description of the purpose and need for action and description of the proposed action. The letter also announced that a public meeting would be held on April 26, 2017, and included details for how, when, and where comments could be submitted. The scoping letter as well as the presentation and handouts provided at the public scoping meeting can be found in the project scoping report.

Thirteen comment letters were received during the scoping comment period. Letters were received from seven governmental agencies, five individuals, and one conservation organization. All but two of the letters expressed support for the project, in that they agreed with the need to implement restoration treatments on the landscape. Generally speaking, the two letters that did not support the proposed action were concerned that proposed treatments would either cause more harm than good to the natural environment, or they favored letting natural conditions correct or restore the ecosystem. The comments were either used to develop the proposed action or to identify the issues to be addressed in the environmental analysis.

1.8 Issues

Issues are concerns about the potential effects of the proposed action on the natural or human environment. The following section provides a summary of issues identified through both public comments received during the scoping period and internal Forest Service discussions. The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; or 3) irrelevant to the decision to be made. The Council for Environmental Quality National Environmental Policy Act (NEPA) regulations require this delineation in Sec. 1501.7, “identify and eliminate from detailed study the issues which are not significant, or which have been covered by prior environmental review (Sec. 1506.3)” Provided below is a description of the eight significant issues that will be addressed in the analysis for the project.

1.8.1 Soil and Water

Implementation of vegetation treatments, road work, and herbicide use could cause resource and watershed health impacts such as: soil disturbance and compaction from mechanical equipment and removal of vegetation; soil scorching from fire treatments; and increased erosion, potential flooding, and sediment loading in waterbodies from removing vegetation and disturbing soils. Some restoration methods could cause changes in water flow and quantity downstream of the project area.

1.8.2 Nonnative Invasive Species

Road construction and improvements, mechanical thinning equipment, and fire treatments could disturb soils and potentially spread weed seeds and root fragments within the project area and into adjacent lands, including private inholdings, and enable nonnative invasive species to become established throughout the project area. Ground disturbance from the proposed action, in combination with other authorized activities, such as livestock grazing, could cause nonnative species to outcompete native plants.

1.8.3 Rangelands and Livestock Management

The proposed vegetation treatments could cause livestock disturbance and displacement; impacts to rangeland infrastructure such as fences, gates, and water developments; loss of forage from burning vegetation or crushing by mechanical equipment; and potential health hazard to livestock from ingesting alligator juniper stumps treated with herbicide. Soil and vegetation impacts from the proposed action cause an area to be rested from additional ground-disturbing activities for a period of time to let native vegetation and soil productivity recover, which could change or limit livestock management opportunities.

1.8.4 Mexican Spotted Owl

Thinning, prescribed fire, and road activities have the potential to disrupt critical life functions for Mexican spotted owls due to noise and habitat alteration, especially in established nest core areas.

1.8.5 Other Wildlife and Plants

The proposed vegetation treatments (thinning, burning, and herbicide applications) could alter habitat for wildlife and plant species, and reduce available forage for wildlife. Reducing vegetation and changing stand composition could cause impact for species associated with closed canopy forest, mature or old-growth forest, large snags, and coarse woody debris. Noise and presence of humans and equipment from implementing thinning treatments could disrupt the critical life functions of wildlife.

1.8.6 Vegetation and Ecosystem Structure and Function

The use of fire and cutting trees in mixed conifer stands could cause impacts to existing old-growth and mature stands, as well as the future development of these features, which are essential habitat elements for Mexican spotted owls, northern goshawks, and other species. Factors such as stand composition (e.g., age, size, and density), slope, aspect, terrain, moisture levels, and other factors greatly influence fire behavior and other ecosystem processes as well as the resiliency of tree stands and whole ecosystems to withstand disturbances.

1.8.7 Access and Closures

During implementation of vegetation treatments, roads closures could restrict access for general forest users and visitors, and could affect access to inholdings, grazing allotments, recreation and hunting activities, and firewood collection.

1.8.8 Social and Economic Conditions

Implementation impacts from the proposed action, such as air quality and visual impacts from fire treatments, the presence, sights, and sounds of machinery, and road closures, could cause reduced visitation to the area and loss of revenues for local businesses. Additionally, the increase of large vehicles and heavy equipment during project implementation could cause road damage and health and safety hazards (e.g., dust and traffic collisions).

However, there are also social and economic impacts that could result from not implementing the project, such as the loss of property, structures, businesses, and even life from a catastrophic wildfire event, as well as the loss of wildlife habitat, forage and wood fiber utilization opportunities, changes to the area appearance and setting, and loss of other forest resources, values, and uses.

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Chapter 2 Alternatives

2.1 Introduction

This chapter describes and compares the alternatives considered for the South Sacramento Restoration Project. It includes a description and associated maps for specific elements included as part of the proposed action. This section also presents the alternatives in comparative form, defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative and some of the information is based upon the environmental, social, and economic effects of implementing each alternative.

Environmental impact statements prepared under Section 104 of the Healthy Forest Restoration Act are subject to the same requirements for National Environmental Policy Act environmental analysis as other projects. Because of the collaborative process, Healthy Forest Restoration Act projects are required to develop only two alternative actions: the proposed agency action and a no-action alternative. However, if during the scoping process or collaboration process another entity proposes an alternative that meets the purpose and need of the project, the agency must also consider that alternative. The proposed action was developed using an iterative process in which adjustments in the proposed land management actions were made incrementally through frequent engagement with stakeholders and the public. Because of the iterative process and incremental changes adopted through public input, additional alternatives were not considered in detail.

2.2 Alternatives Considered in Detail

2.2.1 Alternative 1 – No Action

Under this alternative, no new vegetation thinning, prescribed fire, herbicide, or watershed improvement treatments would be implemented in the project area. Implementation of any previously approved projects and planning of future projects that may affect the area would continue (e.g., fire suppression, management of nonnative invasive plants, fuels reduction projects, rangeland management, road maintenance, and others). The no action alternative for this project includes consideration of long-term projections of forest conditions and trends and wildland fire risk. The no action alternative does not address the purpose and need for the project; however, it serves as a baseline against which the effects of the action alternative can be compared.

2.2.2 Alternative 2 – Proposed Action

In response to the purpose and need, the Forest Service proposes to conduct restoration activities on approximately 140,000 acres in the southern Sacramento Mountains over the next 10 to 20 years to meet initial project objectives, with additional maintenance treatments beyond 20 years. Restoration activities would occur in all ecosystems in the area, including mixed conifer, ponderosa pine, pinyon-juniper, riparian areas, meadows, and aspen habitat types. Restoration activities would focus on thinning and burning treatments to improve forest health and resiliency by reducing stand density, continuity, and homogeneity (sameness of forest structure and species composition), and increase heterogeneity (diverse forest structure and species composition) at a landscape scale, mid-scale, and fine scale.

The project area includes areas of the Lincoln National Forest, Sacramento Ranger District that either have not been previously treated or that were previously treated but require additional treatments to support forest restoration and other habitat management goals. Treatments would be aligned with old-growth development and large-tree retention objectives, which are ecosystem components that are generally lacking in the project area, as described in Chapter 1.

Restoration Methods

The proposed action is designed to provide a wide range of restoration methods that could be used to achieve desired conditions at the fine scale, mid-scale, and landscape scale. Each restoration method has a related set of tools that may be used on any given location depending on the characteristics of the specific treatment site, such as vegetation type, topography, presence of federally listed species, etc. This approach provides flexibility and is known as the “toolbox” approach. The Forest Service would apply the most appropriate tool or combination of tools to achieve desired results. Before carrying out treatments, project leaders would look at the specific area to be treated and select the appropriate treatment tool(s) using an interdisciplinary resource review process. The tools that may be considered as well as the circumstances under which they may be applied are described in detail in the following sections. Table 2-1 provides a general overview of the restoration methods and associated tools that could be used to implement the proposed project. The sections below provide greater detail about the proposed restoration methods and tools.

Table 2-1. Summary of Restoration Methods and Associated Activities that Comprise the Proposed Action

Restoration Method/Associated Activities	Tools to be Used for Implementation
Vegetation Thinning Free Thinning of all Tree Sizes Thin from Below Group Selection with Matrix Thinning between Groups	• Hand thinning • Mechanical whole tree • Manual harvesting • Cut to length • Skyline yarding • Machine piling • Mastication
Use of Fire Prescribed Fire Management of Wildfire to Meet Multiple Objectives*	• Broadcast burning • Pile burning • Jackpot burning • Mobile incinerators
Herbicide Applications	• Daubing or wicking and wiping • Foliar application • Basal bark • Frill or hack and squirt • Cut-stump
Other Restoration Methods Site Rehabilitation and Planting Watershed Improvement and Erosion Control Water Developments Recreation Sites Interpretive Sites	• See Other Restoration Methods section of Section 2.2.2 Alternative 2 – Proposed Action for details.
Special Use Authorizations	• Potential locations for forest industry activities, such as sorting yards, log processing sites, mobile incinerator sites, etc.
Road Management	• Road construction and reconstruction • Road maintenance and relocation • Temporary road closures • Rehabilitation of unauthorized routes

* Considered as a Connected Action, see Section 2.2.4, Connected Actions

Considerations for Mexican Spotted Owl Habitat

Restoration methods, including vegetation thinning and prescribed fire, are proposed in Mexican spotted owl protected activity centers and recovery habitats. The goal in Mexican spotted owl habitat is to improve the quantity, quality, and distribution of owl habitat. Vegetation thinning and prescribed fire treatments would be strategically located and prioritized to mitigate the risk of large wildland fires while minimizing impact to owls and their habitat. Restoration treatments would be designed in coordination with the U.S. Fish and Wildlife Service and align with the latest Mexican spotted owl recovery plan (U.S. Fish and Wildlife Service 2012). Treatments are expected to improve habitat resiliency by reducing the risk of stand-replacing fires and reducing the occurrence and extent of insect and disease outbreaks within owl habitat. Treatments are also expected to maintain existing habitat elements and to promote the development of future habitat in forest stands that are not currently suitable for nesting and roosting or only provide marginal habitat. The proposal would also include design criteria and protection measures designed to limit the impacts to this species (see Section 2.2.5 Resource Protection Measures).

Implementation of treatments within Mexican spotted owl protected activity centers would occur using a phased approach. Treatments would initially be implemented in seven protected activity centers following an implementation schedule approved by the U.S. Fish and Wildlife Service. Pre- and post-treatment monitoring would occur so the impacts of treatments can be understood before proceeding with treatments in additional protected activity centers. Monitoring criteria and methods are described under the Implementation, Adaptive Management, and Maintenance section of Section 2.2.2 Alternative 2 – Proposed Action.

Vegetation Thinning

Vegetation thinning treatments implemented within the project area would include free thinning of all tree sizes, thin from below, and group selection with matrix thinning between groups. Specific prescriptions would be developed prior to implementation of treatment activities. These prescriptions would vary based on presence specific resources or forest stratums, such as Mexican spotted owl habitat, northern goshawk habitat, or old-growth requirements. Table 2-2 provides the post-treatment tree density objectives for each ecological response unit.

Table 2-2. Vegetation Thinning Treatments Elements by Ecological Response Unit

Ecological Response Unit	Vegetation Thinning Treatments							
	Free Thinning		Thinning from Below		Group Selection with Matrix Thinning			
	Basal Area Objectives (square feet/acre)	States Treated	Basal Area Objectives (square feet/acre)	States Treated	Group Size Range	States Treated	Basal Area Objective (square feet/acre)	States Treated
Mixed Conifer with Aspen Forest	60 to 80	Sapling, small tree (VSS 1&2) and aspen states	70 to 90	Small tree (VSS 1&2) closed states	1 to 4 acres	Mid-sized (VSS 3&4) tree states and/or with forest health issues	70 to 90	All
Mixed Conifer–Frequent Fire Forest	40 to 60	Mid-size tree (VSS 3&4) closed states	70 to 90	Sapling, small (VSS 1&2) and mid-sized (VSS 3&4) tree states	1 to 2 acres	Mid-sized (VSS 3&4) and large (VSS 5) tree states and/or with forest health issues	60 to 80	All

Ecological Response Unit	Vegetation Thinning Treatments							
	Free Thinning		Thinning from Below		Group Selection with Matrix Thinning			
	Basal Area Objectives (square feet/acre)	States Treated	Basal Area Objectives (square feet/acre)	States Treated	Group Size Range	States Treated	Basal Area Objective (square feet/acre)	States Treated
Ponderosa Pine Forest	40 to 60	Mid-size (VSS 3&4) and large (VSS 5) tree closed states	60 to 80	Sapling, small (VSS 1&2) and mid-sized (VSS 3&4) tree states	1 to 2 acres	Mid-sized (VSS 3&4) and large (VSS 5) tree states and/or with forest health issues	50 to 70	All
Pinyon-Juniper Grassland	15 to 35	Sapling and small (VSS 1&2) tree states	NA	NA	1 to 4 acres	Small (VSS 1&2), mid-sized (VSS 3&4) and large (VSS 5) tree states, closed and open states and/or with forest health issues	40 to 60	All

Note: VSS = vegetation structural stage (see Section 3.2.1 and glossary for full definition)

In total, approximately 54,000 acres would be restored using vegetation thinning treatments. Table 2-3 presents the estimated acres of proposed vegetation thinning treatments that would occur in the project area, by ecological response unit. Table 2-3 includes proposed treatments both within and outside of Mexican spotted owl protected activity centers. Table 2-3 also shows the percentage of treatments, by ecological response unit, that would occur on slopes greater than 40 percent. For example, approximately 12 percent of the vegetation thinning treatments within the mixed conifer with aspen forest ecological response unit would occur on slopes greater than 40 percent. Table 2-4 shows proposed treatments within Mexican spotted owl protected activity centers and recovery habitat as well as northern goshawk habitat.

Table 2-3. Proposed Vegetation Thinning Treatments (in acres) by Ecological Response Unit

Ecological Response Unit	Free Thinning	Thin from Below	Group Selection with Matrix Thinning	Total Acres to be Treated	Projected Percent of Total Acres over 40 Percent Slope
Mixed Conifer with Aspen Forest	4,400	1,200	7,500	13,100	12
Montane/Subalpine Grassland	1,000	-	-	1,000	-
Mixed Conifer–Frequent Fire Forest	2,500	4,000	15,000	21,500	8
Ponderosa Pine Forest	400	4,200	3,600	8,200	8
Pinyon-Juniper Woodland	-	-	10,000	10,000	2
Gambel Oak Shrubland	-	-	-	-	-
Pinyon-Juniper Grassland	100	-	10	110	-
Mountain Mahogany Mixed Shrubland	-	-	-	-	-
Total Acres	**8,400**	**9,400**	**36,110**	**53,910**	**9**

Table 2-4. Proposed Vegetation Thinning Treatments (in acres) by Ecological Response Unit and Species Habitat Stratum

Ecological Response Unit	Free Thinning	Thin from Below	Group Selection with Matrix Thinning	Total Acres to be Treated
Mixed Conifer with Aspen Forest	**4,400**	**1,200**	**7,500**	**13,100**
Mexican spotted owl (protected activity center)[1]	1,200	-	2,500	3,700
Mexican spotted owl recovery habitat[2]	3,200	1,200	5,000	9,400
Montane/Subalpine Grassland	**1,000**	**–**	**–**	**1,000**
Northern goshawk/ post-fledging family area	10	–	–	10
Other	990	–	–	990
Mixed Conifer–Frequent Fire Forest	**2,500**	**4,000**	**15,000**	**21,500**
Mexican spotted owl (protected activity center)[1]			9,900	9,900
Mexican spotted owl recovery habitat[2]	2,500	4,000	5,100	11,600
Ponderosa Pine Forest	**400**	**4,200**	**3,600**	**8,200**
Mexican spotted owl protected activity centers[1]	–	–	1,500	1,500
Northern goshawk/ post-fledging family area (Non-Mexican spotted owl protected activity center)[1]	40	200	100	340
Northern goshawk/Foraging	360	4,000	2,000	6,360
Pinyon-Juniper (Grassland and Woodland)	**100**	**–**	**10,010**	**10,110**
Northern goshawk/post-fledging family area[1]	10	–	510	520
Other	90	–	9,500	9,590

[1] This stratum would be managed to either maintain or develop old-growth characteristics. Densities would follow Mexican spotted owl recovery plan and northern goshawk guidelines (as established in GTR-310). Old-growth allocation guidelines will be met by following Mexican spotted owl and northern goshawk guidelines.

[2] Mexican spotted owl recovery nest/roost habitat is included within total Mexican spotted owl recovery habitat acres.

Free Thinning of all Tree Sizes

This vegetation thinning treatment would focus on removing the least-healthy trees of any size and favor shade-intolerant, early-succession species in a stand, such as Douglas-fir, ponderosa pine, and pinyon, regardless of size, that have been reduced due to competition and struggle for water, nutrients, and sunlight. Free thinning would also be used as a sanitation treatment in stands that have a high level of dwarf mistletoe infection, where at least half of the host trees are infected and group selection treatments are determined to be ineffective at controlling the level of infection because of the general widespread nature of the infection. Free thinning would primarily be used in mid-sized tree units that have high tree density and high levels of dwarf mistletoe or other tree health factors that require a higher intensity of treatment. These conditions are estimated to occur in about 10 percent of these units. Approximately 8,400 acres would be restored using this thinning treatment (Table 2-3 and Table 2-4).

Thin from Below

Thin from below would be used to improve tree growth, tree vigor, and create stand structure that would meet uneven-aged desired conditions by removing unhealthy, intermediate, and suppressed trees and providing more growing space for the residual trees. The primary purpose is to adjust species composition and concentrate growth on the most desirable trees while reducing fuel continuity and modifying fuel arrangement. This type of thinning would occur in young, even-aged stands with the objective of accelerating growth, reducing tree densities, and improving species composition. This treatment would focus on the removal of young trees, typically less than 9 inches DBH. As discussed above under free thinning, treatment would favor desirable, shade-intolerant species, such as Douglas-fir, ponderosa pine, and pinyon. Approximately 9,400 acres would be restored using this thinning treatment (see Table 2-3 and Table 2-4).

Group Selection with Matrix Thinning between Groups

Group selection is the removal of small groups of trees in order to start a new cohort (Helms 1998). Matrix thinning is thinning treatments between the groups designed to improve tree growth, tree vigor, and create stand structure that would meet uneven-aged desired conditions. This prescription is intended to apply guidelines and methods established in RMRS-GTR-310 (Reynolds and others 2013) and in Forest Service desired conditions guidance (U.S. Forest Service 2014b) as described in Chapter 1. This is an uneven-aged method that can be used effectively to convert one- and two-storied (even-aged) stands to a three-storied (uneven-aged) structure in line with desired condition goals. Uneven-aged silvicultural systems would be used in the mixed conifer, ponderosa pine, and pinyon-juniper ecological restoration units.

Group selection would maintain uneven-aged structure, providing time for tree regeneration within the unit. This type of treatment creates a grouped or patchy forest pattern of different tree sizes and age classes, which increases the horizontal diversity of a stand. The treatment can limit dwarf mistletoe spread within the stand by removing isolated pockets of infection when infections are at low to moderate levels. When applying this method, thinning within the matrix portion of the treatment unit is conducted to target a specific tree density as measured by the basal area of residual trees. This method is designed to improve tree growth, tree vigor, and create stand structure that would allow uneven-aged conditions to develop in the future. The target density would increase by ecological response unit, which more or less transitions along an elevational gradient. Approximately 36,110 acres would be restored using this thinning treatment (see Table 2-3 and Table 2-4).

Vegetation Thinning Treatments within Mexican Spotted Owl Protected Activity Centers

When applied to Mexican spotted owl protected activity centers, the vegetation thinning restoration methods would be adjusted to retain a higher overall tree density and maintain a larger average tree size. These prescriptions were developed by following the direction in the latest Mexican spotted owl recovery plan (U.S. Fish and Wildlife Service 2012). The objectives of the vegetation thinning treatments in Mexican spotted owl protected activity centers are described in Table 2-5.

Free Thinning of all Tree Sizes

Within Mexican spotted owl protected activity centers, this treatment would be used primarily to remove conifer completion from stands of moderate to high-density mature aspen stands and to thin younger stands of mixed conifer. Approximately 1,200 acres within the mixed conifer with aspen ecological response unit would be treated using this thinning treatment (see Table 2-4).

Thin from Below

This method would be used on a limited basis within Mexican spotted owl nest cores and would be limited to removal of trees less than or equal to 9 inches DBH to address ladder fuel of concerns within a nest core. The U.S. Forest Service would determine the need for treatment within nest cores on a case-by-case basis with the U.S. Fish and Wildlife Service.

Group Selection with Reserves and Matrix Thinning between Groups

This method is also referred to as variable density thinning with skips and gaps (Harrington and others 2009; Mazza 2009). This differs from group selection due to placement of non-treated reserves or "skips" within the unit. This would be the primary vegetation thinning treatment within Mexican spotted owl protected activity centers. Group selection would maintain uneven-aged structure, providing time for tree regeneration within the unit. This type of treatment creates a grouped or patchy forest pattern of different tree sizes and age classes, which increases the horizontal diversity of a stand. The goal is to improve protected activity center resilience to wildfire, resilience to insects and disease damage, and enhance forest structural diversity by favoring larger or older forest structures.

Skips of high density and cover ranging in size from 2 to 13 acres would be left untreated, ideally with larger patches closer to the nest core. Skips would be larger on moister ecological response units. The treatment can limit dwarf mistletoe spread within the stand by removing isolated pockets of infection when infections are at low to moderate levels. When applying this method, thinning within the matrix portion of the treatment unit is conducted to target a specific tree density as measured by the basal area of residual trees. This method is designed to improve tree growth, tree vigor, and create stand structure that would allow uneven-aged desired conditions in the future. Table 2-5 provides the post-treatment tree density objectives and gap and skip size ranges for each ecological response unit.
The target density would increase by ecological response unit, which more or less transitions along an elevational gradient.

Table 2-5. Vegetation Thinning Objectives within Mexican Spotted Owl Protected Activity Centers

Ecological Response Unit	Vegetation Thinning Treatments											
	Deferment		**Free Thinning**		**Thinning from Below**		**Group Selection with Matrix Thinning and Reserves (Variable Density Thinning with Skips and Gaps)**					
	Basal Area Objectives (sqft/acre)	**States / VSS Classes Treated**	**Basal Area Objectives (sqft/acre)**	**States / VSS Classes Treated**	**Basal Area Objectives (sqft/acre)**	**States / VSS Classes Treated**	**Gap Size Range Percent of Stand**	**Group Cuts: States / VSS Classes Treated**	**Skip Size Range, Percent of Stand**	**Skips States / VSS Classes Treated**	**Basal Area Objectives Matrix (sqft/acre)**	**Matrix Thinning: States Treated**
Mixed Conifer with Aspen Forest Non-Core	Stands or partial stands with <140	Healthy Mid-sized to large tree closed states (VSS 3-6)	80 to 150	Sapling, small tree (VSS 1-2) and aspen states	NA	NA	0.5- to 2-acre gaps 10%–15% of stand	Mid-sized (VSS 3-4) tree states and/or with forest health problems	2- to 7-acre skips 28%–38% of stand	Large closed tree states VSS 5-6	80 to 110	All states / VSS Classes 47%–62% of stand
Mixed Conifer–Frequent Fire Forest Non-Core	Stands or partial stands with <120	Healthy Mid-sized to large tree closed states (VSS 3-6)	NA	NA	NA	NA	0.5- to 2-acre gaps 10%–15% of stand	Mid-sized (VSS3-4) tree states and/or with forest health problems	2- to 7-acre skips 28%–38% of stand	Large closed tree states VSS 5-6	80 to 110	All states
Ponderosa Pine Forest Non-Core	Stands or partial stands with <110	Healthy Mid-sized to large tree closed states (VSS 3-6)	NA	NA	NA	NA	0.5- to 2-acre gaps 10%–15% of stand	Mid-sized (VSS3-4) tree states and/or with forest health problems	2- to 7-acre skips 28%–38% of stand	Large closed tree states VSS 5-6	80 to 110	All states
Nest Core	NA	NA	NA	NA	90 to 160	Mid-size to Large tree States / VSS 3 -6 ≤ 9-inch DBH trees	NA	NA	NA	NA	NA	NA

Note: BA = basal area; sqft = square feet; NA = not applicable; VSS = vegetation structural stage (see Section 3.2.1 and glossary for full definition)

Within Mexican spotted owl protected activity centers, vegetation treatments objectives would be as follows (see Table 2-5):
Deferment would occur where stand conditions are healthy and sustainable:

- mixed conifer with aspen forest (non-core) stands or partial stands having less than 140 square feet/acre of basal area composed of tree patches of healthy mid-sized to large trees
- mixed conifer frequent fire forest (non-core) with stands or partial stands having less than 120 square feet/acre of basal area composed of tree patches of healthy mid-sized to large trees
- ponderosa pine forest (non-core) with stands or partial stands having less than 110 square feet/acre of basal area composed of patches of healthy mid-sized to large trees

Free Thinning would be used to maintain mature aspen components of stands where sapling and young conifer trees are beginning to compete with the mature aspen overstory:

- residual basal areas would range between 80 and 150 square feet/acre

Thinning from Below would occur infrequently in nest cores to address concerns with ladder fuels:

- residual basal areas would range between 90 and 160 square feet/acre
- nest cores are typically composed of mid-size to large tree states (VSS 4-6), only understory trees less than 9 inches DBH would be removed

Group Selection with Matrix Thinning and Reserves (Variable Density thinning with Skips and Gaps) would occur in all non-core stands in all forest ecological response units:

- Gaps are group cuts, they will range in size from 0.5 to 2 acres, they would remove unhealthy tree groups and excess patches of young to mid-sized trees, approximately 10 to 15 percent of the stand would become a gap.
- Skips are untreated patches ranging in size from 2 to 7 acres, they would be tree groups/patches composed of the largest trees in the stand, approximated 28 to 38 percent of the stand would be retained as skips.
- Matrix thinning would occur between the skips and gaps, residual basal area within the matrix would range between 80 and 110 square feet/acre, approximately 47 to 62 percent of the stand would fall within the matrix.

Approximately 20 percent of total non-core protected activity center acres within the project area could be mechanically treated; these areas would be selected with the assistance of the U.S. Fish and Wildlife Service. All Mexican spotted owl protected activity centers may eventually be treated through an adaptive management process, working closely with the U.S. Fish and Wildlife Service. Treatments would be implemented to mitigate the risk of large wildland fires while minimizing impact to protected activity centers and would strive to mimic natural mosaic patterns. No Mexican spotted owl nest cores would be treated mechanically without concurrence from the U.S. Fish and Wildlife Service and within the guidelines of the recovery plan, and any treatments within nest cores would be highly limited and guided by reducing risk and improving sustainability of the nest core.
Prior to implementing vegetation thinning treatments within Mexican spotted owl protected activity centers, a site-specific prescription would be written to address the desired conditions presented for Mexican spotted owl in Section 1.4.1 Existing and Desired Conditions.

In addition, a minimum of 20 percent mixed conifer ecological response units would be managed for Mexican spotted owl nest/roost habitat, and if treated, would be with prescriptions that meet the latest Mexican spotted owl recovery plan. Table 2-4 identifies the estimated acres of vegetation thinning treatments that would occur within Mexican spotted owl protected activity centers. The estimated 15,100 acres of vegetation thinning treatments within the protected activity centers are included in the total vegetation thinning estimates presented in Table 2-3 above.

Tools for Implementing Vegetation Thinning

Each restoration method has a related set of tools that may be used on any given location depending on the characteristics of the specific treatment site, such as vegetation type, topography, presence of federally listed species, etc. The Forest Service would apply the most appropriate tool or combination of tools to achieve desired results within a specific treatment area. The tools listed below for vegetation thinning would be used in combination with other restoration methods, such as prescribed fire and herbicide application.

The overall goal of the vegetation thinning tools would be to reduce the existing tree density from current levels to a target residual tree density as described in the desired conditions for each ecological response unit (presented in Chapter 1). Long-lived, fire-resistant, shade-intolerant species (typically ponderosa pine and Douglas-fir) would be favored for retention. Treatments would focus on preserving large, old legacy trees where they occur of the early-seral, fire-resistant species where they are present or preserving a cohort of the largest trees in a stand that are likely to develop into old growth. In these areas, smaller, suppressed trees surrounding large trees designated for retention may be removed to improve vigor of the larger trees, remove ladder fuels, and increase resistance to insect and disease attack.

Hand Thinning

Hand treatments refer to the use of hand tools such as chainsaws, brush cutters, loppers, and other methods that do not require the use of heavy machinery, vehicles, or similar equipment. Manual methods would most likely be used on slopes that are inaccessible by heavy equipment or in areas where use of mechanical methods would cause significant, unavoidable harm to resources. Hand treatments would be primarily used under the following scenarios but would not be limited to these scenarios:

- Personal and commercial fuelwood harvesting
- Incidental tree removal connected to other treatments (i.e., road improvements, watershed improvements, near infrastructure, etc.)
- Within Mexican spotted owl or northern goshawk habitat
- Within inventoried roadless areas
- To meet precommercial thinning objectives
- To reduce tree encroachment in meadows and similar habitats
- To remove any green tree or snag that poses a safety risk to workers, the public, property, or infrastructure
- On areas that are inaccessible to mechanical equipment
- As required by the resource protection measures

Hand thinning could occur within any ecological response unit. This tool could also be used to implement vegetation thinning within Mexican spotted owl protected activity centers outside of core areas.

Mechanical Removal

Mechanical removal refers to a variety of possible tools used to meet objectives. Mechanical tools include equipment and vehicles designed to process trees and slash; transfer (or yard) material to landings; pile slash; chip or masticate woody material; and transport material. Merchantable wood products would be removed from sites where feasible based on road access, slope, terrain, and economic factors. Non-merchantable wood and thinning slash may be removed or treated on-site depending on site-specific objectives. Wood product utilization would include, but is not limited to: biomass, fuelwood, post and pole, and sawtimber.

The purpose of mechanical removal is to enlarge the growing space for desirable trees and reduce tree competition for limited site resources, thus promoting improved tree growth, vigor, and resilience to insect and disease. This treatment would be used to reduce fuel quantities and disrupt fuel continuity. Mechanical removal implemented using a commercial contract would likely focus on recovering economic value of timber at least 9 inches DBH.

Removal of merchantable wood products consists of the following phases: 1) felling the trees; 2) processing the trees into logs and removing the limbs (this could be done at the stump or at the landings); 3) skidding logs or whole trees to landings; 4) loading logs for transport; and 5) hauling to mill or other wood product processing facility. Trees may be felled and limbed either mechanically or manually. Skidding to landings, loading logs for transport, and hauling would be completed using heavy equipment.

Terrain, access, soil constraints, length of slope, direction of yarding, equipment availability, and other factors would dictate site-specific harvest methods. Ground-based systems use wheeled or tracked equipment that transport trees or logs to landings. Generally, ground-based yarding systems are used on slopes with less than a 40 percent gradient. However, newer forwarders and harvesters can allow for ground-based operations on slopes up to 80 percent. Because the availability of newer forwarders, harvesters, and other technology that would allow the use of ground-based harvest systems is currently limited in the local area, most vegetation thinning on slopes over 40 percent would be achieved using cable-based yarding systems. Newer ground-based equipment may be used on steeper slopes if they are locally available in the future. All reasonable and practical harvest systems would be considered to achieve desired conditions. Some harvest systems, such as helicopter yarding systems, are cost prohibitive and are not readily available in this area. Therefore, these techniques are not proposed under the proposed action.

Timber harvesting systems that would be used to implement the South Sacramento Restoration Project, and are discussed in four groups:

- Mechanical Whole Tree
- Manual
- Cut to Length
- Skyline Yarding

Mechanical Whole Tree

Mechanical whole tree is the most common harvesting system used in the southwest United States. It consists of several machines performing specialized functions. First a feller-buncher (Figure 2-1) cuts the trees with some type of saw head and then places them into bunches for subsequent removal.

Figure 2-1. Tracked feller-buncher.

A rubber-tired grapple skidder (Figure 2-2) then drags whole trees that have been bunched by the feller-buncher, to a roadside landing area. A forest tractor could also be used to push trees over, exposing the roots (Figure 2-3). At the landing, a processor (Figure 2-4) removes limbs from trees and cuts them into log length. Finally, a loader (Figure 2-5) places manufactured logs onto a truck for transportation to a mill. Logging slash (limbs and tops) generated at the landing can be burned on-site, scattered on skid trails to reduce erosion, or chipped and removed as biomass. Mechanical whole tree harvesting is generally limited to slopes of 40 percent or less, although some equipment, such as a tracked feller-buncher, can work on steeper slopes. Site-specific terrain conditions and equipment specifications would be considered when developing site-specific prescriptions.

Mechanical whole tree removal could occur within any ecological response unit; however, it is traditionally used in mixed conifer and ponderosa pine forests. Emerging technology may make this tool more feasible to use in pinyon-juniper communities. This tool could also be used to implement vegetation thinning within Mexican spotted owl protected activity centers, outside of core areas.

Figure 2-2. Grapple skidder.

Figure 2-3. Example of tree pushing.

Figure 2-4. Log processor.

Figure 2-5. Log loader.

Manual Harvesting

In manual harvesting, trees are cut with a chainsaw. A rubber-tired skidder drags the stems or logs to a roadside landing just as in mechanical whole tree. Trees may be delimbed and cut into logs in the harvest unit or skidded whole to a roadside landing area and processed there.

Manual harvesting could occur within any ecological response unit; however, it is traditionally used in mixed conifer and ponderosa pine forests. Manual harvesting would be allowed in pinyon-juniper as part of the proposed action. This tool could also be used to implement vegetation thinning within Mexican spotted owl protected activity centers, outside of core areas.

Cut to Length

The cut to length harvest system consists of a harvester (Figure 2-6) that cuts trees with a bar saw and then, without releasing the tree from the machine's cutting head, delimbs and processes the tree into logs. Limbs and tops are placed in front of the machine and are crushed down as the harvester moves ahead. A forwarder (Figure 2-7) then follows in the harvester's trail and loads the cut logs on the machine. These logs are carried to a roadside landing free of the ground. Repeated trips by the forwarder on the trail crush the slash into the ground. Slash may be burned or left untreated. Equipment such as bulldozers could be used to pile slash. See the Prescribed Fire section below for more information about these treatments.

Figure 2-6. Harvester.

Figure 2-7. Forwarder on 65 percent slope.

In the past, cut to length has been limited to slopes of approximately 40 percent, however recent developments in technology now allow some models of harvesters and forwarders to operate on slopes of up to 80 percent slope for downhill forwarding and 65 percent uphill.

Cut to length could occur within any ecological response unit; however, it is traditionally used in mixed conifer and ponderosa pine forests. Emerging technology may make this tool more feasible to use in pinyon-juniper communities. This tool could also be used to implement vegetation thinning within Mexican spotted owl protected activity centers, outside of core areas.

Skyline Yarding

Skyline yarding uses a system of cables (Figure 2-8) to drag logs or whole trees from the cutting unit to a roadside landing. It is used on sites that are too steep for ground-based operations. A skyline yarder (Figure 2-9) remains stationary on a road and supplies the power to operate the cables which pull in the harvested trees. Corridors are typically 12 feet wide and can run the entire length of a hillside. Roughly parallel “corridors” for the skyline need to be placed every 80 to 120 feet. Corridors must have all trees removed from them to facilitate yarding. Trees can be mechanically cut if the ground conditions allow for feller-bunchers or harvesters to operate, otherwise felling is done by hand with chainsaws. Logs are laterally moved to a corridor and are then hauled up the skyline to the landing.

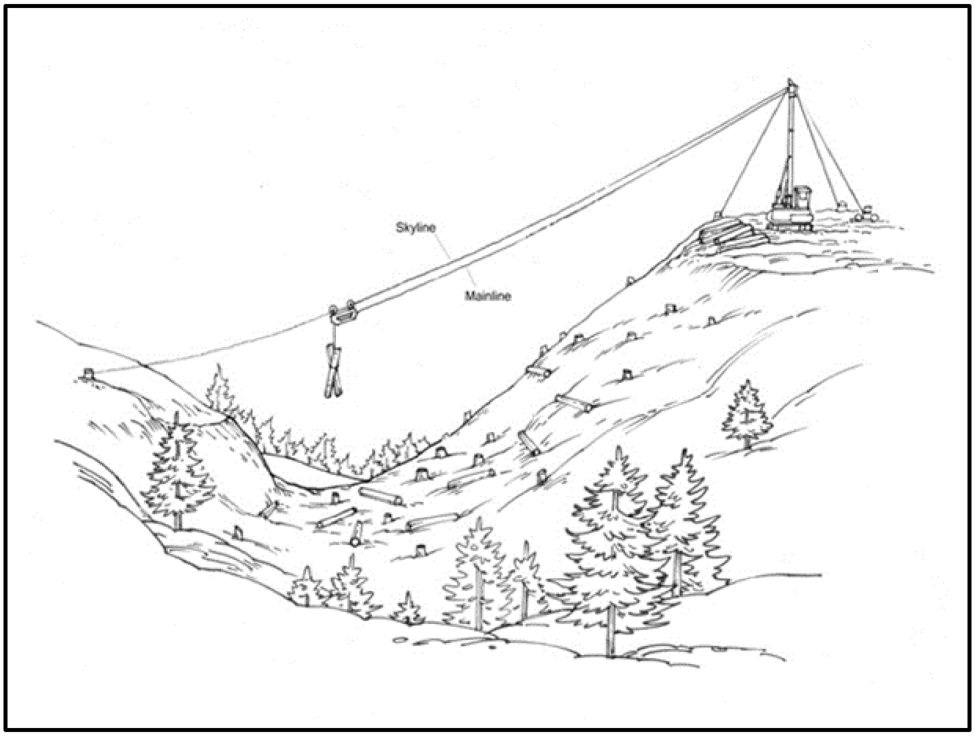

Figure 2-8. Illustration of a skyline logging system. Tops of the logs or trees may drag on the ground.

Figure 2-9. Skyline yarder.

When treatments are completed, corridors would be largely undetectable because stands as a whole would be more open.

Log landings would be adequately spaced throughout a given treatment area and would be located on level to gently sloped ground. Log landings would be large enough to allow for log processing and decking (i.e., for units that would require whole tree skidding).

Table 2-6 displays various equipment configurations for ground- and cable-based timber harvesting systems.

Table 2-6. Timber Harvesting Systems

Yarding System	Logging System	Equipment Configuration	Notes
Ground-Based	Whole Tree (mechanized felling)	Wheeled feller/buncher, wheeled/tracked skidders, log processor, chipper, loader	Logs are processed on the landing. Slash at landings. Manual felling may be required in some stands for oversized trees.
	Cut to Length (mechanized felling)	Wheeled harvester, wheeled forwarder, loader	Logs are processed in the woods. Slash left in forest. Manual felling may be required in some units for oversized trees.
	Cut to Length on Steep Slopes (grades up to 80 percent)	Advanced 8-wheeled harvester, advanced 8-wheeled forwarder, loader	Logs are processed in the woods. Slash left in forest. Manual felling may be required in some units for oversized trees. Advances include dual bogie axles with Trac-bands, synchronized winch assist.
	Conventional (manual felling)	Wheeled/tracked grapple or cable skidder, loader	Process logs in the forest or at the landing (if at landing, processor equipment such as a de-limber would be required).
Cable-Based	Cut to Length (mechanized felling)	Harvester, skyline or cable yarder (numerous yarding configurations) and loader	Logs are processed in the forest. Slash at landings. Manual felling may be required in some units for oversized trees.
	Conventional (manual felling)	Skyline or cable yarder (numerous yarding configurations) and loader	Logs are processed in the woods or at the landing (if at landing, processor equipment such as a de-limber would be required)

On-Site Treatment Methods

Vegetation and fuels can also be treated on-site without being removed. Treating fuels on-site could be carried out in areas where removing the material is not practical or desirable, or in areas where the material being cut has little or no commercial value. Three on-site treatment tools are described below and could be used to implement the South Sacramento Restoration Project: machine piling, mastication, and plucking.

Machine Piling

In some cases, fuel resulting from thinning can be piled on-site for subsequent burning with equipment. This is usually done either with a bulldozer or an excavator (Figure 2-10). Equipment is able to make larger piles than could be accomplished manually. These piles may be burned under much wetter conditions and more snow cover than hand piles.

Figure 2-10. Excavator piling slash.

<u>Mastication</u>

Masticators (Figure 2-11) are machines with teeth attached to either a rotating drum or spinning disc that comprises a masticating head. This head breaks brush and smaller trees down into small pieces. Masticating heads can be attached directly to the frame of the machine or on the end of a boom. Mastication reduces fuel height and fuel size but does not remove vegetation from the site. It is most commonly used in sapling-sized conifers and juniper vegetation types.

<u>Plucking</u>

Emerging technologies suggest that potential forest products for the biomass industry exists in pinyon-juniper vegetation communities. Therefore, in some cases, an excavator or tractor with a thumb attachment could be used to extract whole trees, including the root crown. This method is referred to as plucking (Figure 2-12). The plucked material would then be chipped or grinded on site with the biomass transported off site.

Figure 2-11. Masticator working in juniper.

Figure 2-12. Example of tree plucking.

Table 2-7 summarizes the various vegetation thinning tools, locations where each tool may be used, and general operating conditions that would be considered when developing site-specific treatment prescriptions.

Table 2-7. Treatment Tools Used to Implement Vegetation Thinning, General Operating Conditions, and Typical Treatment Areas

Treatment Tool	Mexican Spotted Owl Habitat Type		General Operating Conditions	Applicable Ecological Response Unit							
	Protected Activity Center (outside Core Area)	Recovery Habitat		MCW	MSG	MCD	PPF	PJO	GAMB	PJG	MMS
Hand thinning	•	•	Typically used in sensitive areas	•	•	•	•	•	•	•	•
Mechanical whole tree	•	•	Typically used on slopes up to 40 percent	•	•	•	•	•	•	•	•
Manual harvesting	•	•	Typically used on slopes up to 40 percent	•	•	•	•	•	•	•	•
Cut to length	•	•	Could be used on slopes up to 80 percent	•	•	•	•	•	•	•	•
Skyline yarding	•	•	Typically used on slopes over 40 percent	•	•	•	•	•	•	•	•
Machine piling	•	•	Typically used on slopes up to 40 percent around landings.	•	•	•	•	•	•	•	•
Mastication	•	•	Typically used on slopes up to 40 percent	•	•	•	•	•	•	•	•
Plucking	•	•	Typically used on slopes up to 40 percent	•	•	•	•	•	•	•	•

Note: Shading indicates ecological response units where treatment tools may be used; however current use is not common.
MCW = mixed conifer with aspen forest
MSG = montane/subalpine grassland
MCD = mixed conifer–frequent fire
PPF = ponderosa pine forest
PJO = pinyon-juniper woodland
GAMB = Gambel oak shrubland
PJG = pinyon-juniper grassland
MMS = mountain mahogany mixed shrubland

Use of Fire

Wildland fire is a general term describing any non-structure fire that occurs in vegetation and/or natural fuels. There are two classes of wildland fire: planned (i.e., prescribed fire) and unplanned (wildfire). Prescribed fire (also called controlled burning) refers to any kind of fire that is planned in advance and applied under preselected conditions that are favorable to meet project objectives. Under certain conditions, wildfires may be allowed to burn to meet identified management objectives. This policy has been referred to as "fire use," "fire managed for resource benefit," "wildfire for multiple objectives," and other terms. Both wildfire for multiple objectives and prescribed fire would be allowed to occur within the project area under the proposed action. More information about the use of wildfire for multiple objectives is provided in Section 2.2.4 Connected Actions. The use of prescribed fire is the focus of this section.

Prescribed Fire

Prescribed fire is an important tool that can reduce the risk of large, uncharacteristically severe wildfires, increase public and firefighter safety, and meet a variety of natural resource management objectives. Land management agencies use prescribed fire in a carefully planned manner to help reduce wildfire risk to communities, municipal watersheds, and other values; restore natural ecologic processes and functions; and achieve integrated land-management objectives. Examples of natural resource management objectives that can be achieved with prescribed fire include habitat restoration, restoring or maintaining ecosystem health, and maintaining vegetation treatments.

Prescribed fire could be used as a stand-alone restoration treatment or could be used after other treatments, for example, to remove slash after initial hand, mechanical, and chemical treatments are completed. It could also be used to emulate the role of "natural" fire. This ensures that slash fuels are dry enough to apply fire prescriptions. Resource protection measures would be applied as appropriate to limit the impacts of prescribed fire on human health and safety, natural resources, and other factors.

Prescribed fire may be used to create, enhance, and maintain a more resilient landscape anywhere within the 140,000-acre project area. Prescribed fires are ignited either by hand or by aerial ignition using aircraft carrying specialized equipment that dispense a fuel mixture to ignite surface fuels. The method of ignition for each prescribed burn unit depends on personnel safety, current and predicted weather, topography, vegetation, and the intensity of the fire needed to meet pre-established goals of the burn. Prescribed fires are typically planned during or immediately following monsoon season, during winter, or at other times of the year when fuels and soils have sufficient moisture to reduce damage to the residual trees, to meet resource objectives, and to confine the fire to the desired burn footprint. Burning operations would be limited to air quality and weather conditions, allowing for safe execution of ignition operations with qualified fire personnel from multiple jurisdictions. Prescribed burning would be staggered across treatment units and planned over several burning periods to limit smoke impacts on a given area as much as feasible and as the availability of qualified personnel and funding allows.

A prescribed fire plan (burn plan) must be completed prior to the ignition of all planned prescribed fires. Burn plans are official site-specific implementation documents prepared by qualified personnel, approved by the agency administrator, and include criteria for the conditions under which the fire would be conducted to meet management objectives.

There are many potential goals that can be achieved by using prescribed fire. Examples include but are not limited to:

- Reduce surface and ladder fuels that contribute to increased risk of uncharacteristically severe unplanned wildfire.
- Reduce risk and help to safely protect local communities from unplanned wildfire.
- Help protect natural resources such as timber and wildlife critical habitat.
- Promote native species and reduce encroachment of invasive species.
- Enhance landscape resiliency and recovery from an unplanned wildfire.
- Improve firefighter ability to safely and effectively respond to and suppress unplanned wildfire.

Use of Prescribed Fire in Mexican Spotted Owl Protected Activity Centers

Prescribed fire would be used in Mexican spotted owl protected activity centers, both within and outside of core areas, outside of the Mexican spotted owl breeding season. Prescribed burns may be allowed within Mexican spotted owl protected activity centers during the breeding season if the protected activity center is unoccupied or the owls are not nesting that year, as inferred from results of surveys conducted according to the Mexican spotted owl protocol. Prescribed fire with Mexican spotted owl protected activity centers and recovery nest/roost habitat would be conducted at low intensity with low-severity effects. Dead and down woody material and snags would be retained following the current Mexican spotted owl recovery plan (U.S. Fish and Wildlife Service 2012).

Tools for Implementing Use of Fire

Broadcast, pile, and jackpot burning are types of prescribed fire that may be used in this project to address the treatment of slash. Additionally, mobile incinerators may be used to reduce activity slash at log landings when whole tree logging is used and only sawlogs are removed, leaving larger quantities of slash that need to be disposed of in concentrated areas.

Broadcast Burning

The application of broadcast burning would occur in a wide array of fuel types, ranging from ponderosa pine and mixed conifer forest to persistent pinyon-juniper woodland, pinyon-juniper savannah and grasslands (Table 2-8). This type of burning can be beneficial for protecting and enhancing habitat and forage availability for wildlife and livestock grazing.

Table 2-9 identifies the acres of treatment proposed specifically for Mexican spotted owl protected activity centers.

Table 2-8. Proposed Broadcast Burning Treatments (in acres) by Ecological Response Unit (including in Mexican Spotted Owl Protected Activity Centers)

Ecological Response Unit	Total Acres
Mixed Conifer with Aspen Forest	17,000
Montane/Subalpine Grassland	1,200
Mixed Conifer–Frequent Fire Forest	50,000
Ponderosa Pine Forest	13,200
Pinyon-Juniper Woodland	14,000
Gambel Oak Shrubland	2,400
Pinyon-Juniper Grassland	120
Mountain Mahogany Mixed Shrubland	10,200
Total Acres	**108,120**

Note: Prescribed fire acreage overlaps vegetation thinning treatments listed above.

Table 2-9. Proposed Broadcast Burning Treatments (in acres) in Mexican Spotted Owl Protected Activity Centers

Ecological Response Unit	Total Acres
Mixed Conifer with Aspen Forest	7,200
Mixed Conifer–Frequent Fire Forest	21,600
Ponderosa Pine Forest	3,700
Total Acres	**32,500**

Note: Prescribed fire acreage overlaps vegetation thinning treatments listed above.

Broadcast burning would be used following hand, mechanical, and chemical treatments to consume surface fuels that are scattered under the forest canopy. Broadcast burning may also be used as an initial treatment where treatment objectives do not require mechanical or hand thinning prior to burning (i.e., maintaining open meadows or in stands to stimulate understory growth) and where the use of broadcast burning would be expected to meet restoration objectives with minimal risk to human health and safety, property, infrastructure, or natural resources. Both manual and aerial ignition methods may be used.

Pile Burning

In most cases, pile burning would be used following hand or mechanical treatments to remove activity slash created during thinning activities. Bulldozers or similar heavy equipment are most commonly used to pile slash. Slash may be hand piled in areas with limited amounts of downed woody debris, where highly erodible soils occur, or on steep slopes and other areas that are not accessible to heavy equipment. Pile burning allows time for the vegetative material to dry out and would produce less overall smoke by burning hot and clean.

The first entry with prescribed fire may be in the form of pile burning to initially reduce the amount of thinned vegetation on the ground. Pile burning may also be used where broadcast or jackpot burning is not an option.

Some snags and downed woody debris would be retained as needed to improve soil condition and nutrient cycling and to meet watershed condition and wildlife habitat objectives outlined in the Forest Plan and in the resource protection measures. New snags may be created to improve wildlife habitat conditions and forest health in areas where existing snags are limited.

Jackpot Burning

Jackpot burning is a modified form of broadcast burning where the target fuels are in concentrated pockets but not piled. The result is a mosaic burn pattern because fuels are not continuous. This technique may be used where surface fuel loading is very high following vegetation treatments such as conifer encroachment in meadows.

Mobile Incinerators

The use of mobile incinerators is an option in easily accessed areas with smaller amounts of target fuels or near developed areas where smoke may be an issue. The availability of mobile incinerators is currently limited but could be more widely available in the future. Use of these types of units can reduce heat impacts to soils by concentrating burning activities in a single location. However, widespread soil disturbance is still possible because fuels often must be pushed or dragged to a single location using heavy equipment.

Table 2-10 summarizes the various prescribed fire tools, locations where each tool may be used, and general operating conditions that would be considered when developing site-specific treatment prescriptions.

Table 2-10. Treatment Tools Used to Implement Prescribed Fire, General Operating Conditions, and Typical Treatment Areas

	Mexican Spotted Owl Habitat Type				Ecological Response Unit							
Treatment Tool	**Nest/Roost Core Area**	**Protected Activity Center (Outside Core Area)**	**Recovery Habitat**	**Criteria for Use**	**MCW**	**MSG**	**MCD**	**PPF**	**PJO**	**GAMB**	**PJG**	**MMS**
Broadcast burning	•	•	•	Used as stand-alone treatment or following thinning treatments to remove activity slash	•	•	•	•	•	•	•	•
Pile burning		•	•	Used following hand or mechanical treatments to remove activity slash	•	•	•	•	•	•	•	•
Jackpot burning		•	•	Used where surface fuel loading is very high following vegetation treatments	•	•	•	•	•	•	•	•
Mobile incinerators		•	•	Used in easily accessed areas or near developed areas to reduce smoke	•	•	•	•	•	•	•	•

MCW = mixed conifer with aspen forest
MSG = montane/subalpine grassland
MCD = mixed conifer–frequent fire forest
PPF = ponderosa pine forest
PJO = pinyon-juniper woodland
GAMB = Gambel oak shrubland
PJG = pinyon-juniper grassland
MMS = mountain mahogany mixed shrubland

Herbicide Applications

Herbicides are another tool that may be used on a limited basis to treat juniper and oak seedlings or to control resprouting in these species. The primary herbicides proposed to treat juniper and oak seedlings and resprouts include picloram, fluroxypyr, and hexazinone, and additional chemicals that may be effective in treating these woody species include aminocyclopyrachlor, imazapyr, metsulfuron methyl, and triclopyr (Table 2-11). New chemicals that come on the market in the future would also be considered for treating juniper and oak seedlings and resprouts. Only herbicide formulations (products) that have been registered with the U.S. Environmental Protection Agency for rangeland, forest land, or aquatic use would be applied. The herbicide label is a legally binding document that provides specific direction on how and where to use an herbicide. All herbicides would be used only as directed on the herbicide label. For example, only herbicides approved for aquatic use may be applied adjacent to water sources, as specified on the label and discussed in the resource protection measures.

Table 2-11. Herbicides Proposed for Use in the Project Area

Common Name	Partial List of Trade Names
aminocyclopyrachlor	Viewpoint® (aminocyclopyrachlor combined with metsulfuron and imazapyr)
fluroxypyr	Vista®, Vista Specialty®, Vista XRT®, Surmount® (combination of picloram and fluroxypyr)
imazapyr	Arsenal®, Chopper® Arsenal AC®, Stalker®, Viewpoint® (aminocyclopyrachlor combined with metsulfuron and imazapyr)
hexazinone	Velpar®
metsulfuron methyl	Escort XP®
picloram	Tordon K®, Tordon 22K®, Surmount® (combination of picloram and fluroxypyr)
triclopyr	Garlon 3A® (marketed as Renovate 3), Garlon 4®, Forestry Garlon 4®, Pathfinder II®, Remedy Ultra®

The Forest Service has completed human health and ecological risk assessments (U.S. Forest Service 2017a) that evaluate the risk of specific herbicides to humans and other species in the environment. The risk assessments in the project record provide more information on the herbicides identified in Table 2-11. Risk assessment can be completed by the Forest Service or other federal agencies. Only those herbicides that have a risk assessment completed would be used. Risk assessments for any new chemicals must be completed before they can be used.

The following herbicide application methods may be used:

- Daubing or Wicking and Wiping: Involves using a sponge or wick on a long handle to wipe herbicide onto foliage and stems. Use of a wick eliminates the possibility of spray drift or droplets falling on non-target plants. Herbicide can drip or dribble from some wicks.
- Foliar Application: Herbicide is applied directly to the leaves and stems of a plant. An adjuvant or surfactant is often needed to enable the herbicide to penetrate the plant cuticle, a thick, waxy layer present on leaves and stems of most plants. There are several types of foliar application tools available. The herbicide can be applied with a backpack or all-terrain vehicle (ATV) sprayer, hand-held bottle, or wick.
- Basal Bark: Applies a band of herbicide at the base of the target plant’s trunk around its entire circumference. The width of the sprayed band depends on the size of the plant and the species’ susceptibility to the herbicide.

- Frill or Hack and Squirt: The frill method, also called the “hack and squirt” treatment, is often used to treat woody species with large, thick trunks. The tree’s bark is cut using a sharp knife, saw, or ax, or drilled with a power drill or other device. Herbicide is then immediately applied to the cut with a backpack sprayer, squirt bottle, syringe, or similar equipment.
- Cut-stump: Used on woody species that normally resprout after being cut. Cut down the tree or shrub, and immediately spray or squirt herbicide on the exposed cambium (living inner bark) of the stump. The herbicide must be applied to the entire inner bark (cambium) within minutes after the trunk is cut. The outer bark and heartwood do not need to be treated since these tissues are not alive, although they support and protect the tree’s living tissues. The cut stump treatment allows for a great deal of control over the site of herbicide application, and therefore, has a low probability of affecting non-target species or contaminating the environment. It also requires only a small amount of herbicide to be effective.

Other Restoration Methods

This section summarizes the other types of restoration methods that may be applied within the project area.

Site Rehabilitation and Planting

Site rehabilitation may be required to mitigate effects caused by the project activities described under the proposed action, including but limited to the rehabilitation of skid trails and temporary roads constructed for treatment activities. Long-term site rehabilitation may also be required following any wildfires that may occur within the project area. Rehabilitation may include reseeding using native grasses and forbs or replanting native woody species.

Planting is a reforestation and revegetation treatment that would be applied to sites that have been deforested due to a wildfire or other severe disturbance. It would be applied when natural regeneration is not expected to occur in a timely manner. Local seed from appropriate seed zones would be used to grow the planting stock at an offsite nursery. Approximately 200 to 400 seedlings per acre would be hand planted using a variable-density stocking pattern. Hand-motorized soil augers, hoedads (similar to a garden hoe but with a longer blade), planting bars, spades, and similar tools would be used. Hand tools would be used to rake down to mineral soil and prepare the soil for planting.

Site rehabilitation and planting activities could occur anywhere within the 140,000-acre project area, depending on need. It is most likely that tree planting would occur in mixed conifer or ponderosa pine forests. Local seed would be collected for appropriate seeding zones.

Watershed Improvement and Erosion Control

Watershed improvement treatments would be designed to help the watersheds trend towards proper functioning condition, as described in Chapter 1. Watersheds that are properly functioning have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients within the range of the natural variability for these processes (U.S. Forest Service 2011a). The improvement techniques employed would be in accordance with the following core principles:

- stabilize active erosion to prevent further degradation;
- improve hydrological function through increased groundwater infiltration; and
- promote vegetation reestablishment where needed to both stabilize soils and restore soil functions.

To meet these core principles, restoration techniques would include the following objectives:

- stabilization of headcuts and other erosion issues in upland areas and along roadsides or similar areas (areas may or may not be associated with the vegetation treatments previously described);
- aeration of select meadows for plantings to increase diversity of forb and grass species;
- stabilization of ephemeral and intermittent channels;
- aid wildlife and livestock distribution;
- repair damage associated with dispersed and informal recreation; and
- improve road and trail conditions.

Approximately 250 miles of intermittent and ephemeral channels have been identified within the project area, although smaller side channels may exist that have not been mapped. Restoration activities within or adjacent to intermittent and ephemeral channels where erosion occurs would be considered where needed to meet the above core principles and project objectives. Specifically, headcuts are areas where erosion results in a sudden drop in the elevation of a channel relative to the adjacent land. If this process goes unchecked, the headcut migrates upstream and creates gullies and deepening of the channel and drains water from the surrounding landscape (Stein and Julien 1993).

Several techniques can be used to stabilize headcuts and gullies and are commonly known as grade control structures or spreading structures. The common grade control techniques that may be used include placing rock, woody debris, or similar materials along intermittent and ephemeral channels (Figure 2-13 and Figure 2-14). This material helps to increase channel friction, slow water velocity which helps capture sediment, recruit native vegetation, and raise the elevation of the channel. Another treatment option involves spreading structures being placed above the gully or headcut, so as to spread the water across the floodplain, slow water velocity, and prevent the concentrated flow through the erosional feature (Figure 2-15). Similarly, where drainages naturally transition from channelized flow to wider sheet flow in valleys and bottomlands, rock or other native materials may be used to reduce outflow water velocity and soil erosion. This allows water to naturally spread across the ground as it continues to flow through the drainage. The effect is similar to a naturally formed alluvial fan.

Figure 2-13. Before: An ephemeral channel on the Cibola National Forest, devoid of all vegetation and a lack of surface roughness that has resulted in erosion and incision of the channel bed.

Figure 2-14. After: The same ephemeral channel shown above that was once devoid of vegetation and channel roughness 2 years after small rock structures were used to slow the water velocity.

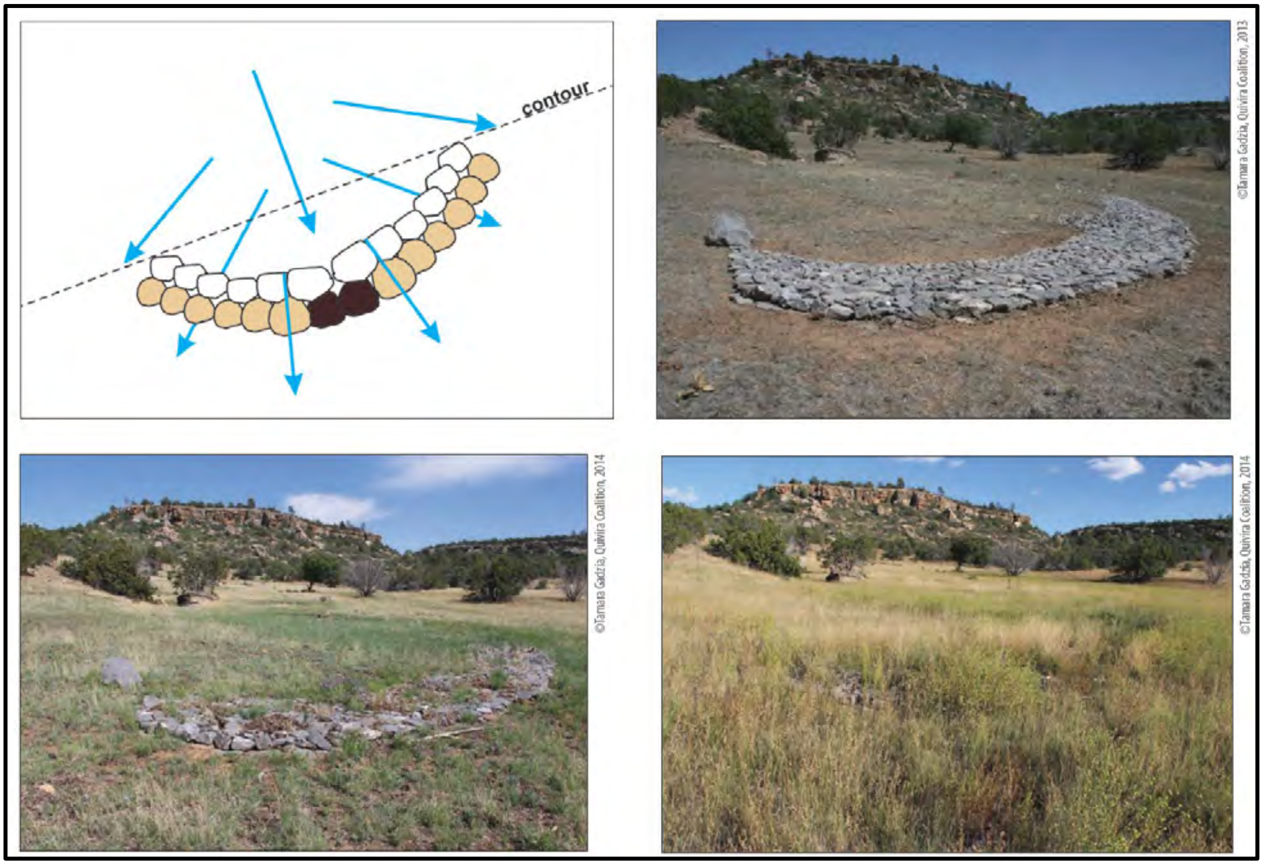

Figure 2-15. Water spreading structures placed above a gully or headcut that spread the water across the floodplain, slow water velocity, and prevent concentrated flow, which can lead to gully erosion (Walton and others 2014).

Additional techniques for large headcuts may include creating a series of small vertical drops and/or shallow pools rather than a single large drop to slow water velocity and trap sediment; or smoothing out headcuts and channels and armoring them with native materials (rock or mulch) to create a more stable angle that prevents the continual undercutting and growth of the headcut. Many times native materials such as trees and rocks can be used to help dissipate the energy from the large drop caused by the headcut (Figure 2-16 and Figure 2-17). Headcuts may also be treated by creating a small meandering channel above a headcut to redirect water flow to the channel below the headcut. This technique diverts most of the flow from the headcut, giving it time to heal without requiring additional treatments (Figure 2-18).

Figure 2-16. Before: A large headcut with a 3- to 4-foot drop on the Cibola National Forest before restoration was implemented using native sourced materials.

Figure 2-17. After: The restored large headcut on the Cibola National Forest, 2 years after restoration was implemented with a log drop.

Figure 2-18. Illustration of where ditches may be constructed on either side of the channel, redirecting flow around the headcut to flow back into the channel below the headcut.

Additional restoration treatments could include in-channel structures and related activities to restore deeply incised channels. Logs, boulders, rock gabions, and similar materials could be anchored to or placed alongside of channels to either redirect or reduce water velocity. This method can reduce or prevent undercutting and other erosion issues within an intermittent or ephemeral channel. In areas where logs, other debris, or previously installed control structures are interfering with flow or are causing erosion problems, these materials would be removed or reconfigured, so they function properly.

The techniques discussed above may be used singly or in combination depending on site needs. Stabilization techniques would include the use of hand tools (including but not limited to shovels, rakes, pry bars, and jackhammers) and heavy equipment (including but not limited to tractors, backhoes, bulldozers, and skidders), depending on site needs, access, and resource concerns. Native materials would be used whenever feasible. Disturbed areas would be reseeded using native forbs and grasses if needed. The restoration treatment techniques would be designed to reduce soil erosion, sedimentation, and water velocity, but would not impede the flow and availability of water.

Upland restoration needs would be determined on a site-specific basis. Emphasis would be placed on locations where erosion threatens the integrity of other resources or where a resource would benefit from upland soil stabilization (e.g., to protect a cultural site; where headcut formation may compromise a road; where mass wasting is compromising channel integrity; around stock tanks where erosion issues are causing them to fill with sediment, etc.). The focus would be on areas with bare soils and active headcutting. Resource protection measures identified in Section 2.2.5 would be followed when implementing watershed improvements.

Water Developments

Water sources are limited on approximately 35,000 acres within the project area. This estimate is calculated by using geographic information system (GIS) software to map areas greater than 1 mile from perennial water or existing water developments. To address these water limitations, additional water developments may be created. Developments would provide water to wildlife, or livestock, or both. New developments would encourage ungulates to use areas that are currently underutilized for forage. Upland water developments may include construction of earthen tanks, umbrella trick tanks, machine drilled wells, pipeline systems, and similar structures.

Recreation Sites

Dispersed camping is a common recreational activity in the Sacramento Mountains. Heavy use can cause erosion issues, especially near perennial and intermittent streams, pools, wet meadows, wetlands, and riparian areas. Along popular motorized and non-motorized trails and established recreation sites, off- road parking can also cause substantial damage to soils and vegetation. Dispersed and established recreation sites would be rehabilitated as needed by replanting native woody vegetation or reseeding using native grasses and forbs. Soil or rock may be spread on-site if erosion problems are severe. Boulders, logs, or similar materials may be temporarily placed as needed to protect newly planted vegetation.

Interpretive Sites

There may be opportunities to develop interpretive sites within the project area. Signs, kiosks, or similar features may be installed for educational purposes at points of interest, including but not limited to:

- historical or prehistorical sites;
- recreation sites and trails;
- along roadsides;
- natural areas with special features; and
- sites where restoration treatments have been completed.

Interpretive sites may be installed using hand tools (e.g., shovels, jackhammers, posthole diggers, etc.), or using equipment attachments (e.g., augers, etc.).

Special Use Authorizations

During public scoping and meeting with project stakeholders, the Forest Service was asked to identify areas within the project area that could be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerator sites, etc. The rationale for identifying these sites is to facilitate more utilization of the forest resource and increase transportation efficiencies. These sites would require authorization by the Forest Service though existing contracting or special use permitting processes.

Tasks carried out at processing sites include drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, scaling and weighing logs, and creating poles from suitably sized logs. Equipment types commonly used at processing sites include circular or band saws, various sizes and types of front-end loaders, log loaders and chippers of several types, and may include timber processors, planers, associated conveyers, and log sorting bunks for accumulation and storage of logs. Electric motors and gas or diesel generators are also used to provide power. Mobile incinerators may also be used at these sites.

Large processing sites are typically greater than 10 acres in size. Large sites allow for more flexibility in their design and allow for more areas to process, grade, scale and sort logs, manufacture materials, and chip and haul products. Medium-sized processing sites are 5 to 10 acres in size and log processing, equipment use, and storage is more limited. Landings at a timber sale area are considerably smaller than log sort yards and typically are about 0.33 acre.

South Sacramento Restoration Project processing sites could be located anywhere within the 140,000-acre project area, based on the following location and siting considerations:

- more than 100 feet from perennial and intermittent stream channels, wet meadows, and springs;
- more than 15 feet from ephemeral channels;
- more than 300 feet from trailheads;
- not within sight of developed recreation areas; system trails (excluding trailheads); private residences, offices, and similar structures that are regularly occupied; or areas with visual quality objectives of "retention" or "partial retention";
- more than 25 feet from cultural resource sites;
- more than 0.25 mile from Mexican spotted owl protected activity centers, northern goshawk post-fledging family areas, or known caves;
- more than 25 feet from areas known to be occupied by the Sacramento Mountain checkerspot butterfly (*Euphydryas anicia cloudcrofti*);
- more than 100 feet from Sacramento Mountain salamander (*Aneides hardii*) sites;
- more than 25 feet from populations of sensitive plant species; and
- more than 200 feet uphill and 100 feet below and alongside areas occupied by federally listed and proposed plant species.

Rock pits and associated access routes would also be developed to provide gravel for road maintenance and rock for watershed improvement work. Gravel pits would be located near system roads to minimize the need for the construction of access routes. Rock obtained from the pits may be used anywhere on National Forest System lands, including areas outside the project area, if needed for other project work.

The processing sites may be used during any time over the 20-year implementation period. Continuous-use processing sites are those where use is expected to be continuous on a regular basis for 10 to 20 years. These sites typically consist of the larger sites, 10 to 15 acres that are located close to primary haul roads. Sites originally developed and operated as continuous use would frequently change to intermittent use or occasional use following initial harvest activities in the area.

Resource protection measures identified in Section 2.2.5 would apply to special use sites.

Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. A National Forest System Road is defined as: "A road wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources" (36 CFR 212.1).

Maintenance Level 1 roads are system roads that are closed to all traffic including administrative use. They are considered in storage for future use. Maintenance Level 1 roads may be temporarily opened and maintained where needed for project access and would be managed per the Lincoln National Forest's Motor Vehicle Use Map upon completion of the project. Open system roads (Maintenance Level 2 through 5) would continue to be maintained as needed. Decisions about changing public access are not included in this project.

Road Construction and Reconstruction

Existing Maintenance Level 1 (closed) roads would need to be reopened and/or reconstructed to provide access and product removal. These new roads may be entirely new construction but may also utilize existing road prisms of unclassified roads that are not currently a system road. These roads would be maintained as needed to complete project activities and closed when no longer needed. Opening Maintenance Level 1 roads to allow access for restoration treatments would include the removal of closure structures or barriers already in place (i.e., dirt berms, boulders, etc.). Some Maintenance Level 1 roads would require clearing of established vegetation since the previous closure. Smoothing road surfaces and widening sections for roads may also be required to make them passable for vehicles and heavy equipment. Upon completion of treatments, Maintenance Level 1 roads would be reclosed using water bars, dirt berms, signs, boulders, or other barriers per the resource protection measures in Section 2.2.5.

In addition, approximately 125 miles of temporary and system roads would be constructed to support implementation of restoration treatments within the project area. A temporary road is defined as: "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 the transportation atlas" (36 CFR 212.1). Temporary roads are generally short spurs built to avoid long skidding distances and skidding on steeper slopes, and to go around wet areas or meadows. Under this analysis temporary roads would be used to maintain maximum skidding distances under 1,250 feet. Temporary roads would be authorized up to approximately 0.5 mile in length. These temporary roads would also receive maintenance as needed to complete project activities. Temporary roads would be obliterated and rehabilitated after vegetation thinning, prescribed fire, and watershed restoration treatments are completed.

Those roads greater than 0.5 mile in length or constructed on slopes greater than 20 percent would be managed as system roads. System roads are typically constructed with a higher level of engineering and planning than temporary roads as they are intended to remain in place for an extended period of time. Following completion of use for the South Sacramento Restoration Project, the new system roads would either be placed into storage as a Maintenance Level 1 road or only be open to Forest Service administrative use. They would not be open to the public unless authorized by a separate National Environmental Policy Act and travel management decision in accordance with Forest Service regulations. No new roads would be constructed within the Jefferies Canyon inventoried roadless area.

Skid distances would be authorized up to approximately 1,250 feet from any system road or temporary road. The combination of temporary roads and skid trails would allow access up to 0.75 mile from any system road in the project area. If harvest areas are beyond this distance, then alternative treatments, such as prescribed fire, mastication, and similar methods that are not dependent on road access, would be considered to meet site objectives. If other methods are not feasible, then the construction of a new system road or the extension of an existing system road may be considered.

Road Maintenance and Relocation

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 as needed. This would be done on roads used to access treatment areas and to haul materials.

Stream crossings and stream interactions would be evaluated to reduce impacts from the roads to streams, soils, and watershed. Hardened low-water crossing, road relocation out of drainages, and surfacing and lining culverts and ditches with rock, concrete, or similar materials may be a few options to minimize the impacts to the landscape. Sections of open roads currently along canyon bottoms may be relocated as opportunities arise to mitigate resource damage. These treatment methods would be evaluated with engineering and resource specialists to determine the most effective treatments that would both resolve road and access issues and protect natural resources. Candidates for relocation could be roads that:

- are too steep to allow for adequate drainage;
- are below the level of the surrounding land and are difficult to drain (relocating these roads to a different location can adequately address the problem);
- are too close to a seasonal or perennial waterbody and contributing sediment to the waterbody;
- involve other unique situations; or
- include any combination of the reasons listed above.

There would be no overall changes in access, number, or mileage of system roads, or road maintenance level where relocation would occur. Relocation of a system road is not considered a new permanent road. It is considered a relocation of an existing road.

This analysis will not identify specific road segments for relocation. Rather it shall provide the authority to relocate roads and road segments at the time that projects are implemented. Roads would be evaluated for relocation at that time.

Temporary Road Closures

Some open system roads may be temporarily closed to the public during project implementation operations for public safety. This would provide for more efficient administrative and contractor use of the roads during treatment activities. The Forest Service would coordinate any closures with local agencies, landowners, or permittees that could be affected by temporary road closures to limit impacts to the greatest possible extent, as described in Section 2.2.5 Resource Protection Measures.

Rehabilitation of Unauthorized Routes

Unauthorized (including user-created and other non-system) routes are any roads or trails that are not part of the established road system as shown on the Lincoln National Forest Motor Vehicle Use Map. Unauthorized routes may be rehabilitated, especially where significant resource damage such as soil erosion is occurring; to promote the safety of all users of those lands; to minimize conflicts among the various land uses; or where road densities exceed recommended levels as described in the Lincoln National Forest travel analysis report (U.S. Forest Service 2008a).

Proposed treatments would restore unauthorized routes to a more natural state. The Forest Service Manual 7712.11 (Exhibit 01) identifies five levels of treatments for road decommissioning which can achieve the intent of the definition (U.S. Forest Service 2001:12). These include the following:

- Block entrance
- Revegetation and water barring
- Remove fills and culverts
- Establish drainageways and remove unstable road shoulders
- Full obliteration recontouring and restoring natural slopes

These five treatment levels provide a wide range of options to stabilize and restore unneeded roads. In some cases, restoration may be achieved by blocking the entrance. In other situations, more extensive actions may be called for.

Specific roads that would be rehabilitated as part of the proposed action are not identified. Rather the project would establish opportunities to rehabilitate unauthorized routes as the need arises during project implementation. No road that is currently designated as open to public use under the Lincoln National Forest's Motor Vehicle Use Map would be decommissioned under this analysis.

Implementation, Adaptive Management, and Maintenance

The South Sacramento Restoration Project is a long-term forest restoration effort at a landscape scale. Implementation of the entire project is anticipated to take over 20 years. Coupled with this size and scope, the project is occurring as the Southwest is experiencing increased climatic changes, such as periods of extended drought and increased temperatures—the effects of which are unknown or at a minimum, untested. The uncertainties inherent in a project of this magnitude mandate that management actions be flexible to accommodate needed modifications. This section describes how the Forest Service would implement projects described above, follow up with maintenance in the treated areas, monitor the results, and adapt future treatments based on the results of earlier treatments (Figure 2-19).

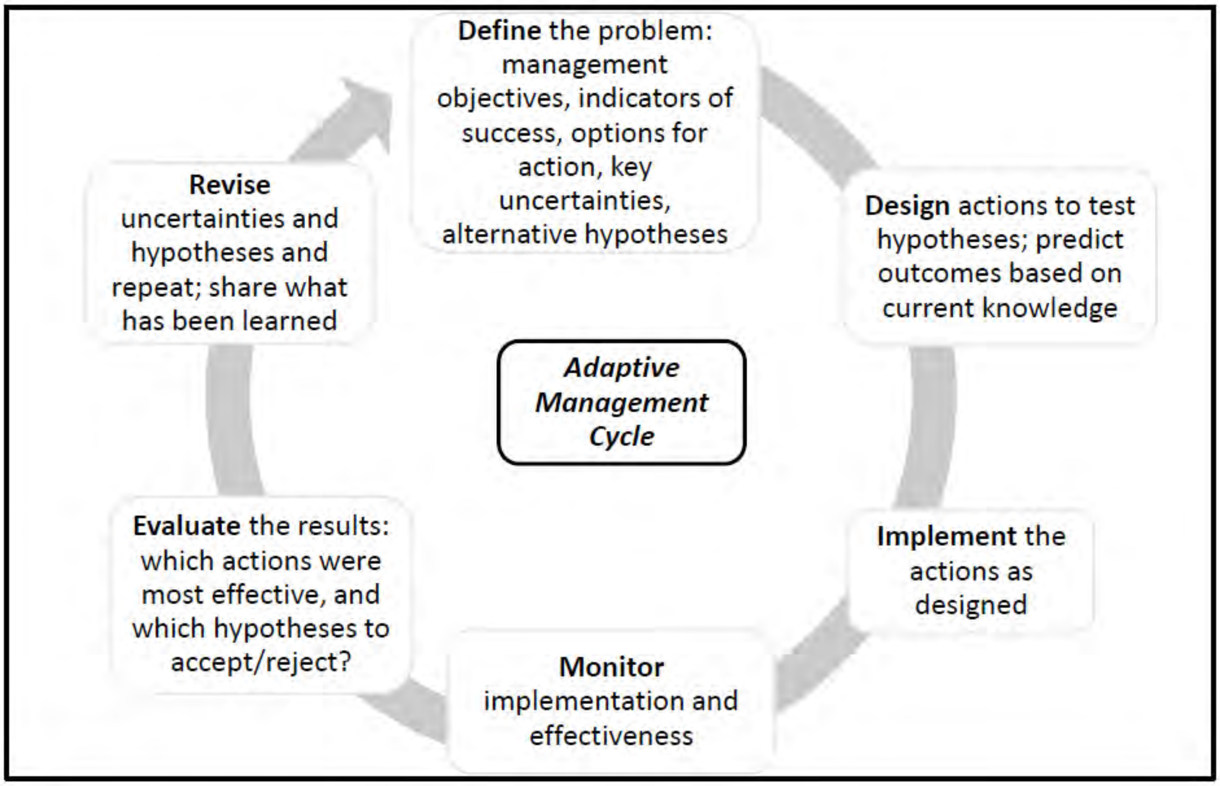

Figure 2-19. The adaptive management cycle (Murray and Marmorek 2004).

Implementation

The proposed project has been developed in collaborative effort with the Forest Service interdisciplinary team, composed of the responsible official, resource specialists, foresters, and fire management staff, and project stakeholders, such as range permittees, neighboring landowners, conservation groups, and local governments. The forest restoration treatments described above are intended to address forest health concerns, protect values at risk, and manage wildlife habitat. These same considerations would be used to guide implementation of South Sacramento Restoration Project treatments over the next 20 years, with maintenance of the South Sacramento Restoration Project treatments occurring beyond the 20-year time frame.

Implementation planning for South Sacramento Restoration Project would occur throughout the life of the project. At this time, the Forest Service has identified near-term treatments that would occur over the first 4 to 5 years of the project, based on six implementation areas that form the South Sacramento Restoration Project area (Table 2-12 and Figure 2-20). It is important to note that these priorities could change as conditions in the project area change, such as wildfire occurrence, wind events, weather conditions, moisture levels, etc. Also, consultation with other agencies, such as the U.S. Fish and Wildlife Service, and available funding could also influence treatment priorities.

Table 2-12. Planned Near-Term South Sacramento Restoration Project Treatments, by Subwatershed

Implementation Area	Acres within Project Area	Planned Treatments
Upper Pinon Creek	33,412	Prioritized for near-term implementation (years 1 and 2 after project approval). Projects could include any of the proposed action components described in Section 2.2.2 Alternative 2 – Proposed Action.
Sacramento River	34,325	Prioritized for near-term implementation (years 1 and 2 after project approval). Projects could include any of the proposed action components described in Section 2.2.2 Alternative 2 – Proposed Action.
Mexican Spotted Owl Treatment Unit 1A	4,552	Prioritized for near-term implementation (years 1 and 2 after project approval). All mechanical thinning prescriptions for protected activity centers and nest/roost replacement habitat will be coordinated with the U.S. Forest Service project biologist and U.S. Fish and Wildlife Service prior to finalization. Following implementation of these prescriptions and monitoring, an adaptive management approach will be followed until all parties are comfortable with the results of the treatments.
Mexican Spotted Owl Treatment Unit 1B	5,054	
Upper Agua Chiquita	23,666	Prioritized for near-term implementation (years 2 to 4 after project approval). Projects would include vegetation thinning and prescribed fire treatments, within Mexican spotted owl protected activity centers. Additional protected activity centers would not be treated until the treatment/reference protected activity centers are studied.
Upper Rio Peñasco	33,217	Prioritized for near-term implementation for watershed improvement and erosion control treatments.
Total	**134,226**	

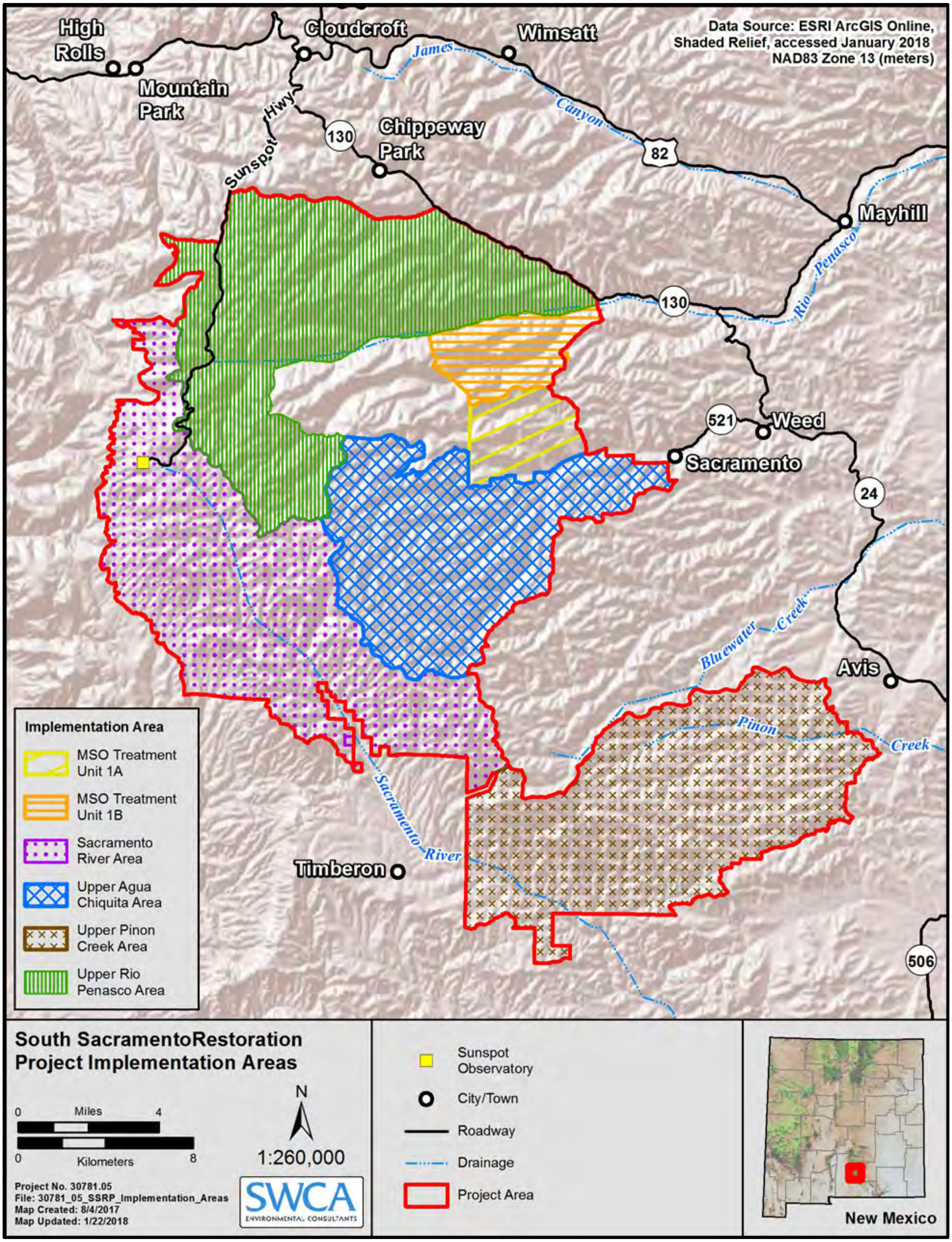

Figure 2-20. South Sacramento Restoration Project implementation planning areas.

The Forest Service would continue to engage project stakeholders during implementation of the proposed action. Implementation activities could be conducted by the Forest Service, contractors, and other project partners. The Good Neighbor Authority, provided by the 2014 Farm Bill and Fiscal Year 2014 Appropriations Act, is one option that could be used by the Forest Service to partner with other parties to implement South Sacramento Restoration Project treatments. The Good Neighbor Authority allows the Forest Service to enter into cooperative agreements or contracts with states to allow states to perform watershed restoration and forest management services on National Forest System lands (U.S. Forest Service 2017b).

Internal Forest Service meetings would be held on an annual basis to prioritize upcoming treatments, identify resource surveys that are needed, and review monitoring results from previous years' treatment. Modeling (such as, but not limited to, FlamMap and FARSite) could be used to identify treatment areas as well as identify the appropriate treatment methods for prioritized areas. Implementation would generally follow these steps:

1. Treatment area is identified.
2. Surveys are conducted for the treatment area. Surveys could include common stand exams, surveys for threatened and endangered species, and/or cultural resource surveys, if the treatment area has not already been surveyed.
3. The Forest Service develops detailed treatment prescriptions and a monitoring plan is developed, based on survey data. Detailed treatment prescriptions are written for each specific treatment area and consider: site characteristics such as slope, sensitive soils, presence of sensitive resources; current stand conditions; regeneration sites; current and desired species composition; and specific forest health issues that may occur at a site.
4. Other restoration treatments (watershed treatments or infrastructure) could be implemented as stand-alone projects or in combination with vegetation thinning and prescribed fire projects. If other restoration treatments are integrated into larger vegetation thinning or prescribed fire projects, restoration designs are developed during the same time detailed prescriptions are written.
5. The Forest Service continues coordination and collaboration with the public and partners that have interest in the project. The level of coordination and collaboration is dependent on the size of the project. Section 2.2.5, Resource Protection Measures, provides more information about coordination and collaboration.
6. Project is implemented as one or more phases.
7. Project is completed.
8. U.S. Forest Service interdisciplinary team reviews project results and outcomes.
9. Monitoring is conducted to determine if treatments were effective at meeting project objectives.
10. Future treatment prescriptions would be developed, and possibly revised, based on monitoring results.

Based on previous projects implemented on the Lincoln National Forest, it is anticipated that implementation of any given treatment activity could take multiple years to accomplish. This includes time to develop burn plans, project-specific prescriptions, conduct timber cruises, write a transportation plan, and construct infrastructure improvements, such as road construction, containment lines, etc. Project implementation timeframes are also influenced by available funding and any necessary contracting steps, if applicable, which must be completed prior to implementation.

Monitoring and Adaptive Management

Adaptive management refers to a "rigorous approach for learning through deliberately designing and applying management actions as experiments" (Murray and Marmorek 2004:1). Monitoring would be completed using best available science and collected data would be used to inform the adaptive management process. The Forest Service would use existing monitoring protocols to determine the effectiveness of treatments conducted in the project area. Examples of existing monitoring protocols that could be used include common stand exams, the Region 3 monitoring protocols, species-specific protocols developed by the U.S. Fish and Wildlife Service and similar requirements developed through consultation with U.S. Fish and Wildlife Service, and monitoring guidelines identified in the Forest Plan. The Forest Service could also opt to use the agency's Administrative Studies Policy, outlined in Forest Service Manual 1900, Chapter 1990, which allows the Regional Forester to conduct studies, either cooperatively, by contract, or in-house, to resolve local problems on National Forest System lands (U.S. Forest Service 1990a).

Monitoring results would be documented and reviewed to determine whether adjustments in design features should be made to maintain or improve resource conditions. The type and frequency for this monitoring would include:

- ***Effectiveness Monitoring***: Scheduled and unscheduled monitoring for the effectiveness of management activities in maintaining or achieving the desired conditions would occur. Monitoring would follow the established monitoring plan written during the site-specific prescription development (see implementation step 3 above). For example, monitoring of Mexican spotted owl treatments would aid in Forest Service and U.S. Fish and Wildlife Service knowledge of how planned treatments affect key spotted owl responses and how identified effects vary among potential treatments. The U.S. Fish and Wildlife Service and Forest Service will monitor owl occupancy rate, reproductive output, and habitat changes as a result of the vegetation thinning and prescribed burning treatments. Occupancy and reproduction monitoring would be implemented for both reference and treatment protected activity centers 1 year prior to treatment, during treatment, and 5 consecutive years after treatment. Vegetation condition monitoring would be done 1 year before treatment implementation and no later than 1 year after it is completed.

- ***Compliance Monitoring****:* To maintain or improve conditions of valued resources, contractor or agency compliance with the resource protection measures would be periodically monitored during project implementation and post-treatment. This type of monitoring would involve scheduled and unscheduled inspections of the project area to ensure all resource protection measures are being implemented.

- ***Implementation Monitoring:*** Project activities and impacts would be actively monitored during project implementation to ensure that resource protection measures are fully implemented to reduce potential adverse impacts on valued resources.

- ***Invasive Plants Monitoring***: Conduct periodic visual surveys for the presence of nonnative, invasive plant species within treatment areas. Where new or expanded populations are discovered, update the invasive plants inventory and notify the Lincoln National Forest so the emerging populations can be prioritized for treatment. New chemicals that come on the market in the future would also be considered for treating juniper and oak seedlings and resprouts. Only herbicide formulations (products) that have been registered with the U.S. Environmental Protection Agency for rangeland, forest land, or aquatic use would be applied.

Monitoring results would be compiled, reported, and submitted to U.S. Forest Service interdisciplinary team members for evaluation prior to the annual project implementation planning meeting. Resource specialists would review the monitoring reports to determine if the completed restoration projects met the desired project objectives. Based on these evaluations, the interdisciplinary team would identify the necessary adjustments for future implementation activities and incorporate the adjustments into future treatment plans and prescriptions.

Follow-up Treatments and Maintenance

Depending on existing conditions, achieving the key elements of the restoration framework may require multiple treatments (e.g., vegetation thinning and prescribed fire) over long time periods. Therefore, the proposed action allows for follow-up treatments and maintenance activities over the long term, to shift existing conditions within previously treated areas towards landscape-scale desired conditions as described in Chapter 1. A regular maintenance schedule (typically every 2 to 20 years depending on the plant association and site-specific conditions) would be established to conduct follow-up treatments and maintain the targeted fire regimes. Any of the treatment tools listed above could be used to re-enter previously treated areas. If prescribed burning cannot be used due to environmental or personnel constraints, then additional hand or mechanical methods would be used to maintain restoration objectives. Maintenance of South Sacramento Restoration Project treatment areas would occur beyond the expected 20-year timeframe of the proposed project.

2.2.3 Forest Plan Amendment

In order to implement the proposed action as described above, a project-specific amendment to the Forest Plan is needed that would authorize the use of restoration strategies in places and under conditions that were not foreseen when the current Forest Plan standards and guidelines were established in 1986. A project-specific plan amendment is a one-time variance in Forest Plan direction. The project is expected to be consistent with the revised Forest Plan when it is finalized.

The amendment would follow the 2012 Planning Rule per 36 CFR 219.17 (b)(2), and per the 2012 Planning Rule substantive requirements (36 CFR 219.8 through 219.11). The amendment would modify Forest Plan standards and guidelines so a wider variety of treatment options and new technologies can be used where appropriate. The amendment includes changes in standards and guidelines as described generally below. A detailed table showing the specific changes to the current Forest Plan is provided in Appendix A.

Updates to Mexican Spotted Owl Direction

The 2012 Mexican spotted owl recovery plan states, "[wildfires] result in the most significant alteration of owl habitat and hence, have the greatest potential for loss of habitat" (U.S. Fish and Wildlife Service 2012:196). Amendment to existing Forest Plan direction would facilitate treatment within and surrounding Mexican spotted owl occupied and critical habitat to prevent habitat loss from high-severity wildfire.

The language for the proposed amendment to existing Mexican spotted owl direction comes from two sources: the current Mexican spotted owl recovery plan and consultation with the U.S. Fish and Wildlife Service for this project. The amendment would change "restricted" habitat to "recovery" habitat. Management of protected activity centers, including "no treatment" cores, recovery habitat, and critical habitat, would follow guidelines provided in the current Mexican spotted owl recovery plan and any additional requirements described in the biological opinion for this project. The amendment would authorize the use of mechanical thinning and prescribed fire within protected activity centers and no treatment cores under certain circumstances. Additionally, the diameter cap would be removed where free thinning of all tree sizes and group selection with matrix thinning treatments are prescribed.

These treatments could occur during the breeding season within occupied protected activity centers on a case-by-case basis and will be outlined in the biological opinion. Treatments would be prioritized to be accomplished within one to two breeding seasons. No single protected activity center would be treated for more than two breeding seasons. If treatments were to extend beyond this 2-year timeframe, breeding season (March 1 to August 31) restrictions would apply for the subsequent years. A monitoring plan would be developed in consultation with the U.S. Fish and Wildlife Service to study impacts of treatments on occupancy, reproduction, and habitat between treated and reference protected activity centers.

Updates to Northern Goshawk Direction

The Forest Plan directs projects to manage for uneven-aged stand conditions within northern goshawk habitat. More recent science has shown that historically, more open spaces were present in the landscape and the importance of such openings or interspaces. The proposed amendment follows management recommendations from General Technical Report RMRS-GTR-310 (Reynolds and others 2013) and the Forest Service Region 3 supplemental desired conditions guidance for the Southwestern Region (U.S. Forest Service 2014b). Wherever Mexican spotted owl protected and recovery habitat overlaps with northern goshawk habitat, the standards and guidelines for Mexican spotted owl would take precedence if direction for these species conflict.

The amendment would align the Forest Plan with best available science describing the structural relationship between forest openings or interspaces, tree groups and individuals, canopy cover, and vegetative structural stage classifications. This amendment does not include those acres proposed for grassland or meadow restoration treatments, which facilitate movement of some ponderosa pine acres towards an open reference condition or those acres where no treatments are proposed. Because Forest Plan canopy cover requirements would be met in vegetative structural stage 4 to 6 and movement towards balanced age classes would occur, the amendment is consistent with the management emphasis of achieving diverse and healthy stands.

The amendment would revise direction pertaining to measuring canopy cover; the percentage of interspaces and tree groups within the landscape; sizing and spacing of interspaces, openings, tree groups, and reserve trees; minimum stocking guidelines; and defines the relationship of these factors to vegetative structural stage. Additionally, the amendment would add definitions for interspace, opening, and tree group.

Updates to General Species Direction

The current Forest Plan prohibits activities that would be likely to cause disturbance in the vicinity of any essential habitat for federally listed species. However, restoration of the landscape including essential habitats is needed to reduce wildfire risk and habitat degradation. An amendment to the current direction is needed to authorize treatment in essential habitat to reduce these risks. Any restoration activities authorized through the amendment would incorporate habitat management objectives and species protection measures from approved recovery plans and conservation agreements; and/or in consultation with the U.S. Fish and Wildlife Service through the Endangered Species Act.

Updates to Mechanical Treatment Direction

To fully meet the purpose and need for the project, vegetation on slopes greater than 40 percent must be treated. Since the Forest Plan was adopted, mechanized ground-based equipment has progressed to be able to operate on steep slopes more effectively. While this specialized equipment is not commonplace in this region due to the high cost of its use, opportunities to use this type of equipment may arise in the future. A project-specific amendment is needed to authorize the potential use of this equipment on slopes over 40 percent in the South Sacramento project area.

Updates to Herbicide Use Direction

The Forest Plan includes limitations related to the use of herbicides within municipal watersheds, near human habitation, and where federally listed species or their prey could be affected. To fully meet project objectives, an amendment is needed to allow the use of chemical treatments to control juniper and oak resprouts to reach and maintain desired conditions on the landscape. Herbicide use would be applied to juniper and oak resprouts using targeted methods to minimize impacts to these sensitive resources. Herbicides would be one tool that could be used individually or in combination with mechanical or prescribed fire treatments to achieve desired conditions.

Updates to Visual Quality Objective Direction

The Sacramento Mountains include areas that are highly valued for their scenic quality. The Forest Plan includes direction to maintain the aesthetics of the area by limiting the visual intrusion of projects on scenery. To meet project goals, however, there would be times where slash management or site rehabilitation following thinning treatments would impact the aesthetic quality of a particular area for a period of time. Therefore, a project-specific amendment is needed to exempt the South Sacramento Restoration Project from meeting visual quality objectives until these rehabilitation activities can be completed. The project emphasizes the need to complete these activities as quickly as conditions allow to limit impacts to scenic quality.

Updates to Unplanned Wildfire Management Policy

Two previous Forest Plan amendments authorized the management of unplanned wildfires for multiple resource objectives on parts of the Lincoln National Forest, including portions of the South Sacramento Restoration Project area. A project-specific amendment is needed so this policy is consistent across the entire project area. With the amendment, natural wildfires could be used as a tool to meet project objectives when conditions allow.

Appendix A contains a detailed discussion of specific text and map changes triggered by the amendment to the current Forest Plan as well as how the plan amendments relate to the substantive requirements outlined in the 2012 Planning Rule. The impacts of the proposed plan amendment to individual resources are discussed in Chapter 3.

2.2.4 Connected Actions

Management of Wildfire to Meet Multiple Objectives

There are two types of fire: wildfire and prescribed fire. All fires receive a management response. Although the locations and circumstances under which wildfires could occur cannot be predicted, there may be opportunities to manage some wildfires within the project area to meet project and other Forest Plan objectives. Reynolds and others (2013) recommend the consideration of strategic placement of restoration treatments to capitalize on the use of wildfire, under appropriate conditions, across broad landscapes.

Wildfire could be used to reduce hazardous fuels, restore fire in fire-adapted ecosystems, improve wildlife habitat, and restore native vegetation. Managing wildfire for multiple objectives would require continuous monitoring, use of minimum impact suppression tactics, and use of resource specialists to ensure that critical natural and cultural resources are not threatened. Wildfires managed for multiple objectives would not be allowed to cross the Forest Service boundary without agreement of the adjacent jurisdictional agency or landowner.

The choice to manage any wildfire to meet forest health, watershed, and resource objectives and not threaten human health and safety, private property, or infrastructure would be made on a case-by-case basis. Current Forest Service policy provides opportunities to manage naturally caused wildfires (i.e., lightning caused) to meet multiple objectives. However, if the policy changes in the future to include the potential to manage any wildfire for multiple objectives or other changes, then the new policy would be adopted. This fire management option would apply only to the project area being considered in this proposal. No other areas on the Lincoln National Forest would be affected unless authorized under a separate NEPA analysis and decision.

The typical time period for considering use of a wildfire to meet multiple objectives is from July 1 through the monsoon and into the fall prescribed fire season. In late June, the monsoonal weather pattern starts to establish. Moisture begins to flow into the region bringing higher relative humidity and less wind. This atmospheric moisture increases the chance of thunderstorms and resulting natural lightning starts. Although this is the most likely scenario when wildfire may be used to achieve objectives, this strategy may be used at any time of year if conditions warrant.

The decision to manage a wildfire, or part of a wildfire, for multiple objectives is dependent on assessing several factors, including risk to firefighters and the public, location, time of season, fire behavior, fuels, human values at risk, cost, and benefit versus risk to natural resources and values. Based on these considerations, fire management staff along with Line Officers and with the input of specialists, would select either immediate suppression or a management strategy which would benefit multiple resources, or a combination of both. Upon deciding to manage a wildfire to meet management objectives, the fire management staff would develop a monitoring and future containment plan for the wildfire and ensure that the firefighting resources are in place for a successful outcome. Management tactics would be designated for the protection of property, infrastructure, and resources. Resource specialists would provide input as to the values at risk and strategies designed to minimize those risks. National fire policy allows part of a fire to be suppressed (e.g., approaching a community), while allowing another flank to burn (e.g., approaching an undeveloped area).

The Wildland Fire Decision Support System is a documentation, analysis, and decision software tool. Forest Service policy requires the use of this tool to assess management risks of unplanned ignitions and to document fire management decisions. This tool would be used whenever the Forest Service considers the management of a wildfire for multiple objectives vs. a full suppression strategy. Post-fire rehabilitation actions, such as reseeding burned areas, may be prescribed based on the final impacts of the wildfire.

Management of naturally caused wildfires for resource benefit is already authorized on approximately 83,190 acres of the project area. In order for the Forest Service to consider managing wildfires for multiple objectives on all National Forest System lands within the project area (covering the remaining 56,981 acres), a project-specific amendment to the Forest Plan would be required (see Section 2.2.3 Forest Plan Amendment). The amendment would change all “Zone A” (immediate suppression) sections within the project area to “Zone C” (expanded suppression with the option to use unplanned ignitions for multiple objectives). The change would align the entire project area to a single wildfire management strategy. Table 2-13 compares the strategic objectives that apply to Zone A and Zone C.

Table 2-13. Strategic Management Objectives for Zones A and C, as presented in the Forest Plan and Lincoln National Forest Fire Management Plan

Zone A Strategic Objectives	Zone C Strategic Objectives
Exchange initial attack zones with the State of New Mexico when an analysis shows that cost effectiveness can be improved. Evaluate all planned and unplanned ignitions for coordination with other resource activity needs. Use fixed detection points (lookouts) as primary method to detect fires. Aerial patrols or detection flights will supplement fixed detection when conditions warrant. Human-caused ignitions will be suppressed utilizing one or a combination of the options available to respond to wildland fire. Fire management activities would be designed to sustain ecosystems, including the interrelated ecological, economic, and social components. All unplanned ignitions will receive a response to the wildland fire. The response will depend on location, fuel, weather conditions, priority, and safety concerns. Fire suppression objectives are established for the three Fire Management Unit types which cover the Lincoln National Forest. Maintain fire forces and their equipment with fire funds allocated for immediate action in the suppression of forest fires which meet the preceding objectives and have a pre-determined action plan.	Exchange initial attack zones with the State of New Mexico when an analysis shows that cost effectiveness can be improved. Evaluate all planned and unplanned ignitions for coordination with other resource activity needs. Use fixed detection points (lookouts) as primary method to detect fires. Aerial patrols or detection flights will supplement fixed detection when conditions warrant. Human-caused ignitions will be suppressed utilizing the appropriate management response for fire. Fire management activities would be designed to sustain ecosystems, including the interrelated ecological, economic, and social components. Utilize planned and unplanned ignitions where feasible and appropriate, to accomplish resource management goals and objectives. All unplanned ignitions will receive a response to the wildland fire. The response will depend on location, fuel, weather conditions, priority, and safety concerns. Fire suppression objectives are established for the three Fire Management Unit types which cover the Lincoln National Forest. Maintain fire forces and their equipment with fire funds allocated for immediate action in the suppression of forest fires which meet the preceding objectives and have a pre-determined action plan. Evaluate existing helispots in light of wilderness designation and maintain only those needed to meet current fire management prescriptions. New helispots for fire pre-suppression will not be constructed.

Sources: U.S. Forest Service (1986a, 2011b)

Managing wildfire for multiple objectives may require the use of fire crews (primarily hand crews and engine crews), hand tools (e.g., shovels, Pulaskis, and chainsaws), and heavy equipment (e.g., bulldozers, fire engines, etc.), which would create ground disturbance. Aircraft may also be used manage and/or monitor the fire. All tools used would be similar to what is used to suppress wildfires.

In 2009, the Forest Plan was amended to permit the management of unplanned ignitions for multiple objectives on select areas of the Lincoln National Forest. This amendment included measures regarding mortality thresholds for the pinyon-juniper, ponderosa pine, and mixed conifer ecotypes. The same mortality thresholds per ecotype parameters would be adopted under the South Sacramento Restoration Project so the direction across the Lincoln National Forest would be consistent, and to be in compliance with other provisions of the Lincoln National Forest Land and Resource Management Plan of 1986 (as amended).

2.2.5 Resource Protection Measures

These resource protection measures are designed to minimize, avoid, or mitigate adverse effects which could occur as a result of implementing proposed treatments for the project. The resource protection measures are based on the Forest Plan direction and policy, best available science, and site-specific evaluations. These are an integral part of this project and are required.

Standard Operating Procedures for All Activities

SOP-1. Develop an annual treatment plan that identifies all treatment sites and proposed methods of treatment. The plan would also identify any required resource protection measures as described herein based on site-specific conditions. The plan would be developed through an interdisciplinary approach by qualified resource specialists as described herein.

SOP-2. An annual pre-operations briefing would be required prior to treatment between Forest Service personnel and the lead contractor(s) or employee(s) who would be implementing the treatment. The briefing would be documented and would serve to brief the implementing personnel on the location of sensitive resources and species and to ensure all appropriate resource protection measures are followed before, during, and after treatment.

SOP-3. Prior to implementation, conduct surveys for federally listed and proposed plant and animal species where suitable habitat exists. If surveys are not feasible prior to implementation, that area would be treated as if occupied. Surveys shall be conducted at the appropriate time of year for plant identification/animal breeding. U.S. Fish and Wildlife Service-approved survey protocols would be followed. If approved protocols have not been established for a species, then subsequent surveys and treatments would be coordinated with the U.S. Fish and Wildlife Service prior to implementation. Apply resource protection measures within these habitats are described in the plant and wildlife sections below.

SOP-4. Prior to implementation, conduct surveys for sensitive plant and animal species where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or wildlife biologist. Surveys would be conducted at the appropriate time of year for plant identification/animal activity. Consult with a qualified Forest Service botanist or wildlife biologist to determine if existing survey data may be used to determine occupancy/absence in a given area. The applicability of previous survey data shall be determined on a case-by-case basis. Apply resource protection measures within these habitats are described in the plant and wildlife sections below.

SOP-5. Conduct surveys for heritage resources prior to implementation and protect them from all ground-disturbing activities. Surveys would be completed for the entire planning area using a phased approach, except for previously surveyed locations. This includes specific units and their ancillary transportation routes, skid trails, landings, etc., where ground disturbance might occur outside of identified units. Apply resource protection measures within eligible sites as described in the Heritage Resources section below. Ongoing consultation with the State Historic Preservation Office and Native American tribes may be required throughout project implementation. Initiation of work in any phase of the project will be contingent upon completion of these consultations as directed by a qualified Forest Service archaeologist.

SOP-6. Establish aquatic management zones (AMZs) and channel buffers along all streams, waterbodies, wetlands, and areas with riparian vegetation to minimize on-site soil movement in these sensitive areas. An AMZ is an administratively designated zone adjacent to stream channels and other waterbodies. Special management controls aimed at maintaining and improving water quality or other water- and riparian-dependent values, including groundwater-dependent ecosystems, should be applied in the delineated AMZ.

SOP-7. Resource protection measures including activities that are allowed or within these AMZs are described below. AMZs shall be designated as follows:

Class 1 streams and waterbodies: a stream segment or waterbody that either supports fish; or that normally flows at least 6 months of the year; or that contributes surface flow to another stream, lake, or waterbody.

- 100 feet from the high-water mark during peak flow.

- Where a road segment crosses a stream, the AMZ shifts from 100 feet to the toe of the fill.

Class 2 streams and waterbodies: a stream segment or waterbody that does not support fish; that normally has surface flow less than 6 months of the year; and that may or may not contribute to surface flow to another stream, lake, or waterbody.

- 100 feet from the high-water mark during peak flow.
- Where a road segment crosses a stream, the AMZ shifts from 100 feet to the toe of the fill.

Class 3 streams and waterbodies: contain no fish, rarely contribute surface flow to other streams or other bodies of water, and normally do not have surface flow 6 months of the year or more. Class 3 streams segments are typically not connected to other streams.

- 15 feet from the high-water mark during peak flow.

SOP-8. The Forest Service shall work with the operator to locate landings, skid trails, yarding corridors, temporary roads, and slash piles in suitable sites to avoid, minimize, or mitigate potential for erosion and sediment delivery to nearby waterbodies or potential impacts to federally listed and sensitive species and heritage resources.

SOP-9. Staging areas, turnaround sites, and landings should be kept as small as possible to minimize bare soils while allowing for safe and efficient operation.

SOP-10. Equipment refueling and servicing would be allowed only at approved locations. All equipment and materials shall be properly stored and maintained in good working order to prevent spills to the greatest practical extent.

SOP-11. A spill prevention, control, and containment plan shall be prepared when hazardous materials (such as but not limited to fuel, oil, oil products, and herbicides) are stored on-site in excess of 55 gallons. Such plan shall meet applicable U.S. Environmental Protection Agency requirements (40 CFR 112). Spill prevention and containment measures shall be installed prior to beginning site-specific activities. Hazardous waste (such as used oil) stored on-site shall not exceed 55 gallons. Hazardous waste shall be disposed of at approved facilities in accordance with state and federal regulations. Contaminated soil and other material shall be removed and disposed of in a manner consistent with controlling regulations.

SOP-12. 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 treatments.

SOP-13. Avoid ground-disturbing operations (including maintenance) during periods of heavy precipitation, stormwater runoff, and soil saturation, especially in areas with unstable or easily compacted soils and on steep slopes. These conditions cause rutting and similar erosion issues.

SOP-14. Develop site-specific erosion control and prevention prescriptions following applicable Forest Service, other federal agency, and state regulations and guidelines. Any required erosion control measures shall be installed prior to beginning site-specific activities. An erosion control and prevention plan may be required to ensure measures are followed.

SOP-15. Promptly rehabilitate or stabilize disturbed areas as needed following project activities. Contour site to disperse runoff, minimize erosion, stabilize slopes, and provide a favorable environment for plant growth. Use methods to reduce soil compaction, especially in heavily compacted areas such as temporary roads, skid trails, landings, etc. Where visual observation indicates that vegetation on disturbed areas is not naturally recovering to limit erosion, use Forest Service-approved weed-free materials and controls on the site. A Forest Service botanist or qualified representative shall identify appropriate seed mixes. Slash may be spread to disguise the disturbed sites and provide a mulch for seeds. Use vegetation species and establishment methods suitable to the project site and objectives, consistent with local direction and requirements per Forest Service Manuals 2070 (U.S. Forest Service 2008b) and 2900 (U.S. Forest Service 2011c) for vegetation ecology and prevention and control of invasive species.

SOP-16. Minimize the placement of log landings, skid trails, temporary roads, staging areas, fire lines, and similar sites wherever these areas are in view of developed recreation sites, private homes or communities, and paved and passenger car–level roads and trails.

SOP-17. Rehabilitate disturbed areas as soon as feasible following implementation so as to not be visible. Rehabilitation may include returning the ground to natural contours, and implementing decompaction and erosion control measures as needed, such as placing slash and rocks across fire lines and covering bare soil with slash, chips, needles, or cut brush as necessary. Restore proper drainage and reseed and mulch using certified weed-free materials as needed.

SOP-18. Prevent the introduction and spread of nonnative invasive plants by applying the following measures:

- Prior to ground-disturbing activities, survey for nonnative invasive plants in project operating areas including landings, permanent and temporary roads, and roads to be closed or decommissioned. Designate weed-free staging areas, landings, and turnaround sites for vehicles and other large equipment. Avoid infestations during project implementation when possible.

- Prior to moving off-road equipment onto the sale area, purchaser shall identify the location of the equipment’s most recent operation. Vehicles, including all-terrain vehicles, machinery, tools, and other equipment used for project implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds prior to entering the project area, when moving from one potentially infested area to another area, and when leaving the project area, if the equipment was previously operating in an area known to have nonnative invasive plants or it is unknown if the area has nonnative invasive species (e.g., private or other ownership, or areas not surveyed).

- If an operator desires to clean off-road equipment on National Forest System land, such as at the end of a project or prior to moving to, or through another area that is free of nonnative invasive plants, the operator shall obtain prior Forest Service approval for a cleaning location including any measures that may be required for controlling impacts.

SOP-19. Disturbed areas shall be monitored for nonnative invasive plants after project activities and site rehabilitation are completed. Any infestations discovered shall be reported to the Lincoln

National Forest weed management program and shall be prioritized for treatment according to established protocols.

Public Safety and Coordination

Public-1. Recreation sites, roads, trails, or other areas scheduled for treatment may be temporarily closed during treatment activities to ensure public safety. Project activities would be coordinated with potentially affected adjacent landowners, range allotment permittees, special use permittees, and any other permit holders as needed to minimize access impacts.

Public-2. Inform forest visitors about activities within the project area and make them aware of potential impacts when visiting this part of the forest. Information may be provided through the Forest Service website, news releases, traffic control and signage, or other measures as appropriate.

Public-3. To further notify Lincoln National Forest visitors and users regarding herbicide use, signs would be placed at access points to treatment areas prior to herbicide application. Signs would include herbicide to be used, effective dates, and phone number for acquiring more information.

Public-4. Coordinated efforts would be made with sponsors of recreational special-use events (i.e., running or mountain biking races) to minimize the impacts on such events within the project area during implementation. Alternative locations would be identified to meet the needs of the special-use event if forest management activities conflict with preferred locations and cannot be resolved through timing.

Public-5. Efforts would be taken to limit forest treatment activities within the project area during high-use weekends and holidays (i.e., Memorial Day, 4th of July, Labor Day, etc.), especially in locations where recreation-based activities occur (i.e., at trails, trailheads, etc.).

Public-6. Avoid crossing or using motorized and nonmotorized system trails where feasible. If a trail or section of trail is affected, the trail shall be restored to the original condition. All treatment slash and debris would be removed from trails. It is acceptable to make perpendicular trail crossings. Trail crossing locations would be designated and flagged with input from a qualified Forest Service recreation staff or designated representative. Crossings of existing forest system trails would be restored to pre-project condition after use.

Public-7. Public outreach efforts (e.g., additional signage, postings at trailhead kiosks, maps on the website) will occur prior to treatment to increase public understanding of what trails are within the forest system (and thus will be protected and/or restored) and which are not.

Vegetation Treatments--Timber Harvesting and Fuels Operations

General Practices

Veg-1. Use ground-based yarding systems only where physical site characteristics are suitable to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources. Use local direction or requirements for slope, erosion potential, mass wasting potential, and other soil or site properties to determine areas suitable for ground-based yarding systems.

Veg-2. Utilize dust abatement methods during project implementation, when deemed necessary by the Forest Service. Coordinate with Otero County on the application and timing of application of dust abatement on road segments that have County maintenance responsibilities.

Veg-3. Forest restoration treatments within close proximity of forest system trails should be "feathered" where feasible so the visual impacts of the treatments are more transitional than abrupt and do not significantly change the character or experience of the trail.

Veg-4. Where possible, mark trees on the side facing away from roads, trails, and developed recreation sites, so marks do not detract from the landscape character.

Veg-5. Where mastication occurs, limit the accumulation of shredded wood to allow for grasses and other ground vegetation to grow up through the shredded woody mulch, based on site conditions.

Veg-6. *Site Rehabilitation* –

- Use suitable measures to stabilize and restore skid trails after use. Use suitable measures as needed to restore and stabilize landings after use. Reshape the surface to promote dispersed drainage. Install suitable drainage features (e.g., water bars, etc.). Mitigate soil compaction to improve infiltration and revegetation conditions. Apply soil protective cover (i.e., slash) on disturbed areas where natural revegetation is inadequate to prevent accelerated erosion before the next growing season.
- Use suitable measures to promote rapid revegetation. Use suitable species and establishment techniques to cover or revegetate disturbed areas in compliance with local direction and requirements per Forest Service Manuals 2070 (U.S. Forest Service 2008b) and 2900 (U.S. Forest Service 2011c) for vegetation ecology and prevention and control of invasive species.
- Skid trails and cable yarding corridors would be restored after use by a combination of any or all of the following practices in order to prevent the concentration of runoff in skid trails and to protect exposed soil: reshaping the surface to promote dispersed drainage (i.e., create convex vs. concave cross section), installation of drainage features such as water bars to shed water, and spreading slash across skid trails and cable yarding corridors to protect areas where mineral soil is exposed. Where skid trails and/or cable yarding corridors intersect existing roads or trails, native materials such as logs, slash, and/or boulders would be placed along the skid trail or cable corridor to line-of-sight, where resources may need protection (e.g., heritage sites, presence of threatened or endangered species).

Winter Logging

Veg-7. Conduct winter logging operations when the ground is frozen or snow cover and depth is adequate to avoid or minimize unacceptable rutting or displacement of soil. Suspend winter operations if ground and snow conditions change such that unacceptable soil disturbance, compaction, displacement, or erosion becomes likely. Compact the snow on skid trail locations when adequate snow depths exist before felling or skidding trees.

Veg-8. Mark AMZ and channel buffer boundaries before the first snow in a manner that will be clearly visible in heavy snows. Mark existing culvert locations before plowing, hauling, or yarding operations begin to avoid or minimize damage from plowing or logging machinery. Restore crossings to near pre-road conditions to avoid or minimize ice dams when use of the snow-road is no longer needed.

Skidding, Landings, Yarding, and Decking

Veg-9. *Site Selection* –

- Locate skid trails, landings, staging areas, yarding operations, and logging decks outside of aquatic management zones and wet meadows.
- Use existing roads and skid trail networks to the extent practicable. Create new skid trails where reuse of existing ones would exacerbate soil, water quality, and riparian resource impacts. Locate skid trails to avoid concentrating runoff and provide breaks in grade.
- Locate landings outside the AMZ and as far from waterbodies as reasonably practicable based on travel routes and environmental considerations. Locate landings to limit the potential for pollutant delivery to waterbodies. Avoid locating landings near any type of likely flow or sediment transport conduit during storms, such as ephemeral channels and swales, where practicable. Locate landings to minimize the number of required skid roads. Avoid locating landings on steep slopes or highly erodible soils. Avoid placing landings where skidding across drainage bottoms is required. Minimize the size and number of landings as practicable to achieve project objectives. Reuse existing landings where their location is compatible with management objectives and water quality protection.
- In meadow restoration sites where wood is being removed, designate skid trails in order to limit disturbance from skidding.
- Use existing roads identified for decommissioning as skid roads in timber sales or land stewardship projects before closing the road, where practicable, as the opportunity arises.

Veg-10. *Design and Use* –

- Design roads and trail approaches to minimize overland flow entering the landing. Perform skidding or yarding operations when soil conditions are such that soil compaction, displacement, and erosion would be minimized. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erodible, or easily compacted soils. Avoid long runs on steep slopes. Do not design a long, straight skid that would direct water flow.
- Skid across intermittent and ephemeral channels only at designated locations.
- To the extent possible, skid trail design would not include long, straight downhill segments which would concentrate runoff. If it is not operational feasible to avoid a long straight downhill segment, skid trail rehabilitation measures would be applied as soon as skidding is completed on that trail. Cable yarding corridors would be located to efficiently yard materials with the least soil damage. Skidding or cable yarding up or down drainage courses would not be permissible unless, in the case of cable yarding, logs are fully suspended.

Veg-11. *Erosion Control* –

- Do not cut trees that will destabilize the drainage. Do not pile slash within the AMZs and channel buffers. Do not allow construction of skid trails, fire lines, or roads within the AMZs and channel buffers, except to cross these areas.

- Identify landings and staging areas for heavy equipment and any in-woods processing sites outside of AMZs, channel buffers, and meadows.
- Use the design features in Forest Service Handbook 2509.22, Chapter 20.24.22 to minimize soil loss and sedimentation (U.S. Forest Service 1990b). The preferred erosion control method on skid trails in harvest areas is spreading slash. Other acceptable erosion control measures include, but are not limited to, water barring, removing berms, seeding, mulching, and cross-ripping. Erosion control after skidding operations must be timely to minimize the effects of log skidding.
- Place slash on or cross-ditch (water bar) skid trails and obliterated roads to break the energy flow of water. Placing slash on skid trails is the preferred method.
- To the extent feasible and as safety permits, trees would be felled to angle in the direction of skidding. This makes it is easier for the skidders to gather and remove the logs and has fewer impacts on the soil.
- Install and maintain suitable temporary erosion control and stabilization measures when the landing will be reused within the same year.
- Drainage from landings and skid trails would be controlled to prevent concentration of runoff.

Slash Management

Veg-12. Unless used for erosion control or maintenance of soil productivity, slash on log landings must be treated. Landing locations within Mexican spotted owl protected activity centers would be coordinated with a Forest Service biologist. Prioritize slash treatment in these locations within 1 year or as soon as possible after treatment.

Veg-13. Areas of project-generated slash suitable for fuelwood gathering (outside of occupied habitat for federally listed, proposed, and sensitive species) could be identified for public use. Those areas would be identified on the Forest Service website and on the map accompanying each fuelwood gathering permit.

Veg-14. Place project-generated slash outside of utility rights-of-way; do not interfere with utility corridor management.

Veg-15. Do not pile slash within AMZs, channel buffers, and wet meadows. Consult with a qualified Forest Service silviculturist, hydrologist or soils scientist or designated representative to determine if slash may be lopped and scattered and broadcast burned on a case-by-case basis. Otherwise, slash should be removed from these areas in a manner consistent with the other resource protection measures as described.

Veg-16. Conduct machine piling of slash in such a manner to leave topsoil in place and to avoid displacing soil into piles. Place slash piles on previously used locations such as old piling sites, old log deck sites, or other disturbed sites to avoid severe disturbance to additional locations where possible.

Veg-17. In visually sensitive areas (e.g., residences, private property, paved or passenger car–level roads or trails, and recreation areas), limit hand piling within 50 feet of these areas. Alternatively, consider slash management techniques that have a lesser visual and noise impact in these areas.

Veg-18. Machine piling of logging slash would be done in such a manner as to minimize the construction of new clearings for slash piles through use of natural openings, temporary roads, and landings.

Prescribed Fire Operations

Rx-1. Follow all New Mexico State Smoke Management Regulation requirements including coordination with New Mexico Environment Department's Air Quality Bureau.

Rx-2. Notify potentially affected or interested parties in advance of burning activities.

Rx-3. To reduce losses of the native seed bank and impacts to soils and watersheds, the size of slash piles and locations would be negotiated with a qualified Forest Service botanist, biologist, soils scientist, and hydrologist or designated representatives in any areas occupied by federally listed species, sensitive species, soils with moderate to high erosion hazard, and/or within AMZs, channel buffers, or wet meadows. To limit overall disturbance and reduce the potential for nonnative invasive plants to establish, pile slash on areas that were previously disturbed, such as old piling sites, skid trails, temporary roads, etc., whenever possible.

Rx-4. In pinyon-juniper habitat, at least 40 percent of existing canopy should be retained. In oak woodlands, prescribed fire should be applied to reduce overall stand density and increase browse availability for wildlife. Burning in mixed conifer may be considered if less than 20 percent of the area would experience complete overstory mortality. Mortality in all habitats should occur in a mosaic pattern and avoiding creating extensive open areas that do not align with desired conditions.

Rx-5. Protect fire-sensitive cultural sites and infrastructure (buildings, utility lines, pipelines, fences, storage tanks, etc.) from fire damage.

Rx-6. When and where possible, use natural barriers and existing roads to limit soil disturbance and construction of new fires lines. Construct drainage structures (water bars, rolls, dips, armor) along fire containment lines as needed to prevent erosion and runoff.

Rx-7. If fire lines are put in place for prescribed fire activities, rehabilitate lines after use by following the site rehabilitation techniques described in the Standard Operating Procedures and Hydrologic Resources sections of Section 2.2.5 Resource Protection Measures. Disguise fire lines past the line of sight from any open road or system trail to discourage use of the fire line as a trail.

Rx-8. On areas treated with prescribed fire, fire prescriptions should be designed to minimize soil temperatures over the entire area. Fire prescriptions should be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall. Conduct prescribed fires to minimize the residence time on the soil while meeting the burn objectives.

Rx-9. After piles are burned, consider scarifying and/or lightly covering bare soils with small woody debris to reduce potential erosion and encourage vegetation growth.

Rx-10. Equipment/vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Slash should not be piled or ignited in occupied sensitive plant habitat as determined by a qualified Forest Service botanist or designated representative. Fire is allowed and expected to creep into these zones.

Rx-11. Where fire lines are in view of roads, trails, and recreation sites, place native materials such as logs, slash, and/or boulders along the first 300 feet or along the line of sight, whichever is greater, to mask the presence of the road and discourage any use as a trail.

Herbicide Use

Herbicide-1. Herbicides would be applied with prescribed environmental conditions stated on the herbicide label and NEPA decision. This includes label instructions required by the U.S. Environmental Protection Agency pertaining to wind speed, relative humidity, water, air temperature, chemical persistence, and time since last rainfall when determining timing of application in relation to drift reduction.

Herbicide-2. Only herbicides with a completed risk assessment would be used, per Forest Service standards. If a risk assessment is updated for new uses, the risk assessments would be reviewed and considered as part of the adaptive management strategy.

Herbicide-3. Herbicide use would be restricted to U.S. Environmental Protection Agency– and the New Mexico Department of Agriculture–registered application rates (usually in terms of pound of active ingredient applied per acre) and conditions listed on the label. Follow-up application of a second herbicide to an area should be conducted only after reviewing best available information on compatibility with previous application’s formulation.

Herbicide-4. Herbicide use would comply with direction contained in Forest Service Manual 2150, including the requirement that a Pesticide Use Proposal (form FS-2100-2) be completed for all proposed herbicide uses on National Forest System lands (U.S. Forest Service 2013a).

Herbicide-5. A pesticide application record would be completed on a daily basis for each project area detailing the herbicide application, treatment area, target species distribution and density, weather conditions, and recommendations for follow-up treatments or rehabilitation. Records of all Forest Service pesticide-use activities must be maintained through the Forest Service’s national database of record. Pesticide-use recordkeeping protocols and requirements are described in the Pesticide-Use Management and Coordination Handbook (Forest Service Handbook 2109.14 [U.S. Forest Service 2016b]).

Herbicide-6. Areas used for mixing herbicides and cleaning equipment shall be located where spillage would not run into surface waters or result in groundwater contamination and would adhere to the other resource protection measures listed in the spill prevention, control, and containment plan.

Road Activities

General Practices

Road-1. Roads (including open, closed, and temporary) will receive maintenance as needed throughout the life of the project or duration of the contract.

Road-2. Control road drainage using appropriate measures including but not limited to: insloping, outsloping, crowning, water spreading ditches, rolling dips, and contour trenching. Reduce sediment loads at drainage structures using measures such as installing sediment filters, rock and vegetative energy dissipaters, settling ponds, or temporary erosion control structures.

Road-3. Install and maintain erosion and stormwater controls as necessary to ensure they are functioning to meet their intended purposes. Routinely inspect all roads used for project implementation (including temporary roads) to verify that erosion and stormwater controls are implemented, functioning, and appropriately maintained. Install controls to reduce the risk of flow diversion onto the road surface.

Road-4. Remove any temporary erosion control structures after soils have stabilized.

Road-5. Use previously disturbed areas for parking or staging where available and outside of AMZs, channel buffers, and wet meadows. Design and locate parking and staging areas of appropriate size and configuration to accommodate the number and types of vehicles expected, including turnaround space. Use measures to harden and avoid or minimize damage to parking area surfaces that experience heavy use or are used during wet periods. Rehabilitate temporary parking or staging areas as soon as practicable following use.

Road-6. Where no requirements exist, dust control measures shall be considered according to the standards and specifications for federal road construction (U.S. Federal Highway Administration 2003). If the road surface is too dry for grading and similar maintenance, apply water to dampen the surface. Alternatively, the project can be scheduled for when adequate moisture occurs to complete the project.

Road-7. Construction of permanent and temporary roads is prohibited in inventoried roadless areas.

Road Construction, Reconstruction, Maintenance, and Storage

Road-8. Prior to using existing roads for project implementation, condition surveys shall be completed to determine maintenance needs. Roads may be relocated to more stable terrain prior to project implementation if they are located on unstable soils or soils with high erosion potential to ensure additional damage does not occur. Road conditions shall be monitored during and after implementation to determine ongoing maintenance and/or rehabilitation needs.

Road-9. Relocate roads out of AMZs to an upland location where substantial resource damage would be mitigated effectively. If roads cannot be relocated, use riprap or other measures to stabilize or disperse water runoff during road maintenance, construction, and reopening of closed roads.

Road-10. Culverts, low-water crossings, and/or bridges may be used for crossing drainages or waterbodies based on site-specific needs. Crossings shall be located to limit the number needed for project implementation. Crossings shall be placed where the channel is narrow, straight, and uniform, and has stable soils and relatively flat terrain to the extent practicable. Crossings shall be engineered to adequately convey high flows and to maintain drainage function. Crossings would be designed to minimize disturbance to the stream or waterbody, and to avoid, minimize, or mitigate adverse effects to channel function, soil stability and function, water quality, riparian resources, and aquatic organisms. Crossings would be located and designed by a qualified Forest Service engineer or other qualified representative in conjunction with overall road design parameters.

Road-11. Hardened low-water crossings may be considered on roads with low traffic volume and slow speeds; where water depth is safe for vehicle travel; and where streambanks are low with gentle slopes and channels are not deeply incised. Low-water crossings shall be constructed to retain channel function and to facilitate the movement of aquatic organisms.

Road-12. Temporary roads will be of the lowest design specification possible while providing adequate access for product removal.

Road-13. Align temporary roads to use topography and vegetation where possible to help screen them from vista points and paved and passenger car–level roads and trails.

Road-14. Permanent roads not needed for access for long periods (more than 1 year) may be put into “storage” to reduce maintenance costs. Maintenance 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. Follow the procedures below when storing roads:

- Close and physically block the road entrance so that unauthorized motorized vehicles cannot access the road.
- Stabilize and revegetate the site in compliance with local direction and requirements per Forest Service Manuals 2070 (U.S. Forest Service 2008b) and 2900 (U.S. Forest Service 2011c) for vegetation ecology and prevention and control of nonnative invasive plants.
- Evaluate all stream and waterbody crossings for potential for failure or diversion of flow if left without treatment. Reshape the channel and streambanks at the crossing site to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of streambanks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site.
- Culverts and other crossings may be left in place in low-risk situations where the culvert is not undersized, does not present an undesired passage barrier to aquatic organisms, and is relatively stable. Remove culverts, fill material, and other structures that present an unacceptable risk of failure or diversion.
- Install measures to ensure that the road surface drainage system will intercept, collect, and remove water from the road surface and surrounding slopes in a manner that reduces concentrated flow in ditches, culverts, and over fill slopes and road surfaces without frequent maintenance.
- Stabilize unstable road segments, seeps, slumps, or cut or fill slopes where evidence of potential failure exists.

Decommissioning and Rehabilitation

Road-15. Temporary roads shall be rehabilitated as soon as practical after they are no longer needed for project implementation. User-created routes causing damage to hydrological resources, cultural resources, or threatened, endangered, and sensitive species habitat; contributing to user conflicts; or are deemed unsafe for use would be prioritized for rehabilitation.

Road-16. The site rehabilitation techniques and other practices described in the Standard Operating Procedures section of Section 2.2.5 Resource Protection Measures would be followed for road decommissioning and rehabilitation. Additionally, any drainage structures that exist (such as berms, culverts, and hardened low-water crossings) would be removed unless they are needed to ensure long-term site stabilization. Consult a qualified Forest Service hydrologist or soils scientist or designated representative to identify site-specific rehabilitation needs.

Road-17. Reshape the channel and streambanks at crossing sites to pass expected flows without scouring or ponding, minimize potential for undercutting or slumping of streambanks, and maintain continuation of channel dimensions and longitudinal profile through the crossing site. Restore or replace streambed materials to a particle size distribution suitable for the site.

Road-18. Where feasible, spread slash across the disturbed area to create microclimates and protect from grazing ungulates during seed germination or install erosion mats. In drainages, limit slash placement to the upper two-thirds of the channel and anchor if feasible to limit downstream transport of woody material. In uplands, consider the use of mycorrhizal inoculum on severely disturbed sites where no topsoil is left.

Road-19. 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.

Road-20. Coordinate stream crossing rehabilitation (channel, shoreline, lake, pond, and wetland activities) with appropriate state and federal agencies.

Road-21. Incorporate Clean Water Act 404 permit requirements and other federal, state, and local permits or requirements into the project design and plan.

Road-22. 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, reestablish drainageways, 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.

Road-23. Temporary roads will be restored as part of the closing work. Remove any berm on the road edge that would hold or channel water. If compaction is evident, road will be ripped before seeding. Install water bars or similar to prevent water from following the decommissioned road. Seed areas of bare soil with certified, native plant rehabilitation mix. Slash may be pulled onto the road. Closure may be a berm, rocks, stumps, or similar barriers to block motorized access. Where temporary roads intersect existing roads or trails, native materials such as logs, slash, and/or boulders would be placed along the first 300 feet or along the line of sight, whichever is greater, to mask the presence of the road and discourage any additional motorized use.

Rock Pits

Rock-1. To the extent possible, rock pits will be located near existing system roads to minimize the need for road construction and reconstruction.

Rock-2. Newly constructed pits will not be located in inventoried roadless areas, AMZs, channel buffers, wet meadows, critical habitat for federally protected species, or areas with a visual quality objective level of “retention” or “partial retention.” Avoid areas with nonnative invasive plants.

Rock-3. Contract provisions for quarrying operations will require operators to obtain the appropriate air quality permits under New Mexico Administrative Code 20.2.72, as applicable, for gravel quarrying, crushing, and screening operations.

Rock-4. Save as much soil as possible during excavation operations. Put measures in place to prevent offsite runoff and soil displacement.

Rock-5. Restore pits after use using the following strategies:

- Restore slopes in excess of 1:2 to less than 1:2 (50 percent slope). Contour entire site to blend into the surrounding area.
- Spread excess waste materials evenly across the area excavated.
- Replace saved topsoil with replant/reseed with native vegetation as approved by a qualified Forest Service botanist or designated representative.
- After restoration, the graded or backfill area shall not allow water to collect or remain in the area.

Worker Health and Safety

Safety-1. Workers involved in herbicide mixing, loading, and application would be required to wear protective clothing per all label requirements and U.S. Forest Service directives (Forest Service Manual 2150 [U.S. Forest Service 2013a]). Workers that apply triclopyr repeatedly (over a period of several weeks) would take precautions to limit their exposure to the herbicide and ensure personal protective equipment does not become contaminated with herbicide.

Safety-2. Drivers shall be briefed on all haul route hazards, defensive driving, and project safety plan, and must be familiar with the spill prevention, control, and containment plan.

Safety-3. Pesticide applicator licensing and training would be used as a quality control measure, as required by the New Mexico Department of Agriculture and U.S. Forest Service directives (Forest Service Manual 2150b [U.S. Forest Service 2013a]). Training and testing of applicators covers laws and safety, protection of the environment, handling and disposal, formulations and application methods, calibration of devices, use of labels and material safety data sheets, first aid, and symptoms of pesticide exposure.

Safety-4. Material safety data sheets would be posted at storage facilities and in vehicles, and made available to workers. These provide physical and chemical data, fire or reactivity data, specific health hazard information, spill or leak procedures, instructions for worker hygiene, and special precautions. The pesticide storage would only be in U.S. Environmental Protection Agency/New Mexico Department of Agriculture–approved facilities. All Occupational Safety and Health Administration (OSHA) guidelines would be followed for pesticide storage and worker notification.

Rangeland Management

Range-1. On active range allotments, consult with the district range staff to discuss the need for timing treatment operations and/or to adjust pasture use during project implementation as needed.

Range-2. After treatments are completed, consider deferring livestock grazing where appropriate to ensure vegetation recovers and soils are restabilized. This would be accomplished by working with permittees and adjusting their annual operating instructions, as necessary.

Range-3. Protect fences from harvesting activities. Temporary cattle guards may be installed if needed. Skid trails and temporary roads will be laid out to avoid cutting fences to the greatest extent possible.

Range-4. Vehicles passing through grazing pastures must leave gates as found upon entering and exiting the area to ensure livestock remain in the correct pasture.

Range-5. Once a project is implemented and complete, cattle guards would be cleaned to pre-implementation condition.

Soil Resources

Soil-1. Forest Service personnel or a designated representative shall ensure that all required erosion control measures are in place prior to conducting ground-disturbing activities. These measures shall be periodically inspected and maintained as needed to serve their intended function. Measures shall remain in place until soils have stabilized.

Soil-2. Inspections and post-treatment monitoring will concentrate on soil condition, ground cover, compaction, soil displacement, and vegetative recovery along skid trails, log landings or decking areas, staging areas, roads, and burned areas. Inspections and monitoring results would be used to inform the effectiveness of the measures used and the need for additional measures to minimize soil impacts.

Soil-3. Where treatments result in exposing bare mineral soil, those sites would be evaluated to determine need for revegetation (e.g., seeding or planting), mulching, or other erosion or sediment control measures and the end of operations or when incomplete operations must be suspended for the season. The evaluation would consider potential for subsequent reinvasion by nonnative invasive species, potential for erosion, water runoff, and/or stream sedimentation. Where seeding is used, U.S. Forest Service Southwestern Region guidance would be followed. Seed mixes would be based on site-specific conditions and objectives.

Hydrologic Resources

Water-1. AMZs, channel buffers, and wet meadows shall be avoided to the extent practicable when placing roads, skid trails, landings, staging areas, logging decks, processing sites, turnarounds, and areas used for similar approved activities. Activities in the AMZ shall be designed to disturb the least amount of area possible while serving its intended function. If AMZs cannot be avoided when designating these activity sites, equipment that is the least impactful but is still sufficient to meet project objectives is preferred. Additionally, brush or slash may be used as a cushion under equipment, as approved by a qualified Forest Service hydrologist, soils scientist, or designated representative to protect sensitive soils from mechanical compaction, rutting, etc.

Water-2. Hand-thinning methods are preferred within AMZs, channel buffers, and wet meadows. Do not cut trees that would destabilize any perennial, intermittent, or ephemeral drainage or the integrity of a spring or seep. Winching trees out of the AMZ is allowed only on dry or frozen soil.

Water-3. If soils are not dry or frozen, materials must be hand carried offsite. Avoid felling trees into drainages or waterbodies, except as planned to create habitat features. Consult with Forest Service hydrologist, soils scientist, or wildlife specialist prior to felling trees.

Water-4. Do not cut any riparian tree species along a perennial waterbody within the primary shade zone of a perennial waterbody.

Water-5. Minimize the number of stream crossings to the extent practicable. Should a perennial or intermittent stream crossing be needed, consult with a qualified Forest Service hydrologist or designated representative to determine site location. Evaluate options for routes that must cross waterbodies and choose the one (e.g., specified road vs. temporary road vs. skid road or trail) that avoids or minimizes adverse effects to soil, water quality, and riparian resources to the greatest extent practicable. Crossings shall have sufficient armoring to prevent damage to soils or drainage integrity.

Water-6. Existing permanent roads may be relocated outside the AMZ whenever feasible and the old road bed rehabilitated.

Water-7. Use suitable measures to avoid or minimize soil disturbance from equipment operations to stay within acceptable disturbance levels when conducting mechanical vegetation treatment operations. Prescribe mechanical site preparation techniques and fuels and residual vegetation treatments that avoid or minimize excessive erosion, sediment delivery to nearby waterbodies, or damage to desired riparian vegetation.

Water-8. Treatment units will be periodically monitored by Forest Service personnel to ensure that all erosion control measures are in place and meeting their intended functions as required.

Plants, Including Threatened, Endangered, and Sensitive Species

Plant-1. Consult with a qualified Forest Service botanist or designated representative prior to scheduling implementation activities to ensure resource protection measures are applied appropriately.

Plant-2. For herbicide use, stream crossings, and rock pit construction, a minimum buffer zone of 25 feet may be applied around known sensitive plant populations; however, depending on site-specific conditions, these buffer zones may be adjusted as needed as determined by a qualified Forest Service botanist or designated representative. Buffer zones will be delineated from the outer perimeter of sensitive plant populations and shall be marked prior to implementing site-specific activities. No set buffer is required for other activities; however, a qualified Forest Service botanist or designated representative must be consulted to determine if protections for sensitive plants must be in place (such as for slash piling). Initial surveys of occupied and potential habitat for sensitive plant species may be completed before site-specific activities occur. Surveys would be conducted at the appropriate time of year for plant identification. Post-activity monitoring may be conducted at some sites to study short and long-term effects to sensitive plants.

Plant-3. Where federally listed and proposed plant species occur, a buffer zone shall be applied around each occurrence depending on site-specific conditions as directed by the U.S. Fish and Wildlife Service and as consistent with recovery plans, conservation plans, agreements, species assessments, and/or Forest Service policy. Where no such guidance is expressly given, a minimum buffer distance of 200 feet uphill and 100 feet below and alongside occupied areas will be delineated. These buffer zones will be delineated from the outer perimeter of sensitive plant populations and shall be marked prior to implementing site-specific activities.

Plant-4. Do not cut, masticate, or remove Wooton's hawthorn (*Crataegus wootoniana*) individuals.

Plant-5. To the extent practicable, design silviculture prescriptions so tree groups are maintained around the highest concentrations of sensitive plants that are dependent on canopy cover, duff, and other characteristics typical of mature stands. Designate areas unoccupied by canopy-dependent sensitive plants or occupied by shade-intolerant sensitive plants as interspaces. These measures will help preserve microhabitat conditions to ensure the persistence of sensitive plants.

Wildlife, Including Threatened, Endangered, and Sensitive Species

General Practices

Wildlife-1. Treatment buffers will be designated around cave entrances, sinkhole rims, and drainages leading to these features to protect cave ecosystems (including microclimate, hydrology, and entrance vegetation) and reduce potential disturbance to roosting bats. No direct ignition of fire within buffer.

Wildlife-2. In woodland habitats, aim for an overall canopy closure of 40 percent.

Wildlife-3. In aspen habitats, aim for an overall canopy closure of 50 percent.

Wildlife-4. In oak habitats, aim for an overall canopy closure of 35 percent.

Wildlife-5. Develop waters (for wildlife and/or livestock) as needed so water is available within 1 mile of any given location. Provide ramps in water tanks, as necessary, to allow small animals to escape. Considering planting native vegetation or trees around new and existing water sources located near roads or in open (visible) areas.

Wildlife-6. Provide protection for known red squirrel (*Tamiasciurus hudsonicus*) caches and raptor nests during nesting periods. Prior to implementation, consult with a qualified Forest Service biologist or designated representative to determine if activity restrictions in these buffers are required.

- Red squirrel caches: 37-foot buffer (0.1 acre total)
- Raptor nests: 330-foot buffer (7.9 acres total)

Wildlife-7. In ponderosa pine and mixed conifer habitat, snags are defined as being greater than 18 inches DBH and a minimum of 30 feet tall. A downed log is defined as being greater than 12 inches midpoint diameter and at least 8 feet long. Downed woody debris is defined as being a minimum of 3 inches in diameter at midpoint.

Wildlife-8. In mixed conifer habitat, retain one group of reserve trees per acre of three to five trees per group for openings greater than 1 acre, and 10 to 15 tons of woody debris per acre. In ponderosa pine habitat, one group of reserve trees, with three to five trees per group, would be left if the opening is greater than 1 acre in size. Additionally, at least two snags per acre, three downed logs per acre, and 5 to 7 tons of woody debris per acre would be retained. If there is not a sufficient number of snags per acre meeting these criteria, then retain the three largest snags or snags with obvious wildlife use (especially tree cavities, broken tops, or lightning strikes) per acre. Emphasize retention of snags exhibiting loose bark to provide habitat for roosting bats. If these features are lacking, create additional snags by girdling or using some other method or retain live trees greater than 18 inches DBH that exhibit these characteristics for future snag recruitment.

Wildlife-9. In pinyon-juniper habitat, retain a minimum of one large tree (at least 12 inches DRC) per 3 acres. In areas with alligator juniper, retain two alligator junipers per acre. Emphasize the retention of the largest tree(s) possible.

Wildlife-10. In areas where large snags are limited, consider modifying unit boundaries and/or treatment prescriptions to reduce losses of large snags or snags with obvious wildlife use.

Species-Specific Practices

Wildlife-11. In **Mexican spotted owl** habitat, apply these measures:

- In addition to the desired habitat conditions and project parameters previously described, follow all other requirements as described in the current recovery plan unless an exemption is granted by the U.S. Fish and Wildlife Service. Consult with the U.S. Fish and Wildlife Service for all activities planned within protected activity centers.
- All Mexican spotted owl protected activity centers, except the ones identified as the treatment protected activity centers in the monitoring design, would adhere to breeding season restrictions (March 1 to August 30). Breeding season restrictions may be dropped if non-breeding is confirmed or inferred that year per the accepted survey protocol.
- Within occupied Mexican spotted owl protected activity centers, avoid loud persistent noises during the breeding season. Removal of hardwoods, downed woody debris, snags, and other key habitat variables should occur only when compatible with owl habitat management objectives. Road and trail use, construction, maintenance, or rehabilitation shall be deferred to the non-breeding season unless approved by the U.S. Fish and Wildlife Service on a case-by-case basis because of pressing management reasons.
- Use of closed roads for project implementation is restricted during the breeding season unless cleared by species survey.
- In nest cores, no road or trail construction shall be permitted unless approved during consultation with the U.S. Fish and Wildlife Service.
- In nest cores, mechanical tree harvest is prohibited.
- In nest cores, planned or unplanned fires may be allowed to enter core areas only if they are expected to burn at low intensity with low-severity effects that would maintain key habitat elements. Plan ignitions away from the nest core.
- Avoid activities within 0.25 mile of protected activity centers during the breeding season that could disturb nesting owls. This restriction may be lifted if surveys show that the protected activity center is unoccupied or if nesting is not occurring. Alternately, activities may occur within 0.25 mile of occupied protected activity centers if surveys and best available scientific information show that topographic features or noise tampering technology provide a sufficient buffer to reduce noise impacts to accepted levels as described in the recovery plan.

- All new and temporary roads and skid trails within Mexican spotted owl protected activity centers would be decommissioned and obliterated after use.
- Coordinate prescribed burning spatially and temporally across the landscape to limit smoke impacts during the breeding season. Maintenance burning within protected activity centers but outside of nest cores could occur during the breeding season. Prescribed fire would be allowed to enter cores only if it is expected to burn with low fire severity and intensity. Fire lines, check-lines, backfiring, and similar fire management tactics would be used to reduce fire effects and to maintain key habitat elements (e.g., hardwoods, large downed logs, snags, and large trees). In Mexican spotted owl protected activity centers, avoid nest areas during prescribed fire operations to the extent possible.
- Fire lines would not be built within core areas or in protected activity centers. Established roads or skid trails could be used as fire lines, but no new fire line construction would occur.
- The Forest Service shall ensure that all contractors conducting project activities are briefed on protocols to be followed in Mexican spotted owl protected activity centers, including how to avoid harassment, report sightings, and what to do if a Mexican spotted owl is incidentally injured, killed, or found injured or dead. If an owl fatality is discovered, all activities shall immediately cease in the vicinity and a qualified Forest Service wildlife biologist shall be immediately notified for reporting purposes. Activities in the area would not be allowed to resume unless authorized by the U.S. Fish and Wildlife Service.
- Contingency plans would be developed in the event that new protected activity centers are established or that boundaries of existing protected activity centers must be modified due to owl movement, habitat changes, or other factors. Flexibility shall be built into the project (including contracts) so project activities can be modified to accommodate these situations. Modifications would be coordinated with U.S. Fish and Wildlife Service.
- The Forest Service shall complete pre- and post-treatment monitoring (e.g., occupancy, reproduction, movements, habitat characteristics, vegetation, and incidental take) and reporting as required by the U.S. Fish and Wildlife Service using approved protocols. The Forest Service shall meet annually with the U.S. Fish and Wildlife Service to discuss treatment activities in Mexican spotted owl and monitoring results from the previous year as well as treatment and monitoring plans for the upcoming year.

Wildlife-12. Work with U.S. Fish and Wildlife Service to develop resource protection measures for the **New Mexico meadow jumping mouse** (*Zapus hudsonius luteus*) and its critical habitat.

Wildlife-13. In occupied **Peñasco least chipmunk** (*Tamias minimus atristriatus*) habitat, apply these measures:

- Whenever possible, avoid having crews of more than five individuals in occupied habitat at one time to limit disturbance.
- In the event that the species is listed, then conferencing with the U.S. Fish and Wildlife Service would occur before continuing treatments in suitable or designated critical

habitat. If this species is removed as a proposed species for listing, then protection measures identified in Forest Service policy and in applicable conservation plans or agreements would be followed.

Wildlife-14. In **northern goshawk** habitat, apply these measures:

- Breeding season restrictions (March 1 to September 30) shall apply as described in the Forest Plan.
- Prescribed burn plans in northern goshawk habitat would be designed and implemented to minimize smoke impacts to nesting birds and minimize loss of nest trees.

Wildlife-15. In **Sacramento Mountain salamander** habitat, apply these measures:

- No more than 40 percent of occupied habitat can be treated within a single stand.
- Retain 10 to 15 tons per acre of large coarse woody debris at least 12 inches in diameter at midpoint and at least 8 feet long.
- Ground-disturbing and prescribed fire activities shall be avoided in occupied habitat during the active season for the species (July 1 to September 30) to avoid crushing individual salamanders and compacting soils. Restrictions may need to be adjusted to account for emergence sooner or later in the year depending on seasonal rain conditions. Consult with a qualified Forest Service biologist each season to determine if timing restrictions should be adjusted.
- For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat.
- Disturbance of soil, rocks, boulders, and large woody debris in occupied habitat will be avoided to the greatest practical extent. Material (e.g., rocks, boulders, logs) used for any purpose to complete the project should not be removed from occupied habitat.

Wildlife-16. In occupied and designated **Sacramento Mountains checkerspot butterfly** critical habitat, follow the approved conservation plan for the species.

Heritage Resources

Heritage-1. Boundaries of eligible sites shall be marked prior to implementing treatment activities to ensure that all protection measures can be applied as described. Within archaeological site boundaries, avoid any ground-disturbing activity, including driving, commercial thinning, construction of fire lines, mop-up actions, slash piling and burning, staging or turnaround of heavy equipment, staging of materials, or use of mechanized or ground-disturbing equipment.

Heritage-2. If previously unidentified cultural materials are discovered during implementation, cease working in the area until a qualified Forest Service archaeologist has been notified and approves restarting the work.

Heritage-3. Cutting within sites will be done using hand methods. Vegetation shall be hand-carried off site to reduce hazardous fuels build-up. Where feasible, use directional felling to keep trees from falling into sites. Cut stumps flush to the ground. Prune remaining trees up to 4 feet above ground level. This will be approved on a case-by-case basis and monitored by a Forest Archaeologist.

Heritage-4. Do not pile slash within site boundaries. Hand carry slash outside of the site boundary or to an area designated by a qualified Forest Service archaeologist. Slash shall not be dragged through a site to avoid ground disturbance. Slash may remain within a site boundary only as directed by a qualified Forest Service archaeologist.

Heritage-5. Slash and logs may be placed, scattered, or chipped within or adjacent to a site where there is active erosion as directed by a qualified Forest Service archaeologist. 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.

Heritage-6. On fire-sensitive sites, brush and heavy fuels may need to be removed prior to the application of prescribed fire as directed by a qualified Forest Service archaeologist. Fire-sensitive sites must be protected from treatment include sites that can be damaged by heat, smoke, or flame, such as those containing combustible items such as wood, or materials sensitive to heat and smoke such as rock art, metal, or glass. Broadcast burning may be carried out on non-fire-sensitive sites under low-intensity conditions. These activities must be approved on a case-by-case basis and monitored by a qualified Forest Service archaeologist.

Heritage-7. Herbicides applied by spray methods would not occur within 25 feet of archaeological remains consisting of perishable materials with analytic or information value, including rock art, wood, organic ceramic paints, datable materials, and residues on artifacts. Within 25 feet of such archaeological remains, consult with a qualified Forest Service archaeologist to determine appropriate site protection methods.

2.3 Alternatives Considered but Eliminated from Detailed Study

One additional alternative was proposed by the public: use prescribed fire as the sole treatment method within Mexican spotted owl protected activity centers. The recommendation is based on the assertion that there may not be a sufficient capacity to achieve the mechanical treatment goals in the project area given the current infrastructure, market values, and industry within the region. After an initial analysis, it was determined that this proposed alternative would not meet various elements of the purpose and need, including reducing insects and disease to improve overall forest health and promote stand resiliency; increasing the ability of fire crews to safely manage wildfire; and increasing our understanding of the short- and long-term effects of land management on Mexican spotted owl habitat (also see Section 1.4 Purpose and Need for Action).

In Mexican spotted owl protected activity centers, forest conditions are typically representative or trending towards older-aged forest structure, including heavy accumulation of both surface and ladder fuels. In these areas there is enough connection with the surface and canopy fuels that it would be difficult, if not impossible, to reduce surface fuels by thinning with fire without killing large, old trees. Using prescribed fire as the only treatment method in dense understories and heavy fuel loads has the potential to cause high-severity effects to both the surface and overstory canopy and/or result in uncontrollable fire behavior. This represents extreme fuel loading and is a hazardous condition which can produce high-severity fire effects. Due to the high risks for stand-replacing fire within Mexican spotted owl protected activity centers, it is unlikely that prescribed fire could be safely applied at a large enough scale to shift existing forest conditions toward the desired range of conditions. In essence, the risks of applying prescribed fire as the only treatment would be so great that few to no treatments would occur. Without effectively treating stands heavily infested by insects and disease, forest condition would trend toward overrepresentation in the younger age classes and continued underrepresentation in the older age classes as older trees die over time.

Additionally, there would continue to be substantial risk for a stand-replacing wildfire to impact protected activity centers resulting in high tree mortality, loss of soil productivity, and the total loss of nesting and roosting habitat. This would be contrary to the need to improve resiliency and sustainability in the project area

Because management objectives within Mexican spotted owl protected activity centers could not be met by this alternative, it was eliminated from detailed study.

2.4 Comparison of Alternatives

Table 2-14 summarizes the potential impacts to resources analyzed in Chapter 3 for the no action alternative and proposed action. For clarification and additional detailed discussion on how the impact analysis was conducted, the reader is referred to Chapter 3.

Table 2-14. Impact Summary Table

Resource Element	Indicator/Measure	No Action Alternative Alternative 1	Proposed Action Alternative 2
Vegetation Community Composition	Vegetation communities or ecological response units; represented by all seral stages and tree density conditions, including old growth, and native and nonnative plant species.	Continued tree mortality from drought, insects, disease and stand-replacing high-severity wildfire. Continued stagnation of closed states, little development of large tree open multistoried states. Overall shifts in the species compositions to shade-tolerant/fire-intolerant species. Increased transitions to shrub-dominated states.	Restoration of existing overgrown forest stands to less dense stands dominated by larger diameter trees and greater understory vegetation cover with reduced high-severity wildfire and drought-induced tree mortality. More frequent low-severity surface fires, and maintenance of open, multistoried tree stands. Persistence of established native vegetation. Some shifts in elevation and slope/aspect as climate change continues.
Vegetation Community Composition	Nonnative plant species: Acres occupied by any nonnative invasive plant species within any land area of project-created soil surface disturbance. Post-action monitoring would be required	Continued degradation of forest environmental health and further increases in nonnative invasive plant species as native vegetation and plant species decline from overgrown forests, high-severity fire, and climate change. High-severity fire creates extensive soil surface disturbances that promote the establishment and spread of nonnative plant species.	Improved environmental and habitat conditions for native forest vegetation communities, and decreased soil disturbance conditions caused by catastrophic wildfire that favors nonnative invasive plant species. Resource protection measures would prevent the introduction and spread of nonnative plants from project actions.
Forest Structure	Vegetation structural stage	Continued dominance of medium-aged stands across all forest and woodland ecological response units, classified as Vegetative Structural Stage 3-4. Greater homogeneity in age/ size classes, reduces stand resistance to insect and disease and heightens wildfire risk. Old-growth stands would continue to decline from adverse effects of stand-replacing high-severity wildfire, attacks from insects and increasing climate induced drought- and water stress–caused mortality of older age–class trees.	Increased diversity of age structures across all forest and woodland ecological response units, with increased acres of forest classified as Vegetative Structural Stage 4-5. Greater heterogeneity in age/size class increases stand resistance to insect and disease and reduced wildfire risk. Tree thinning would focus on smaller-diameter and younger trees, freeing water and nutrient resources for larger and healthier trees, promoting development of old-growth components over time. Reduced high-severity wildfire that threaten old-growth structural components.
Forest Structure	Trees per acre	Continued high numbers of trees per acre relative to desired conditions across all forest and woodland ecological response units. High stand density increases competition between trees, reducing tree vigor and therefore reducing stand resilience to insect and disease; stands would be at a greater wildfire risk.	Reduced trees per acre across all forest and woodland ecological response units. Lower stand density increases available resources, improving growth potential and vigor and improving stand resilience to insect and disease. Reduced tree density helps break up fuel continuity (vertically and horizontally) reducing wildfire risk and catastrophic fire effects.
Forest Structure	Basal area: Total combined square footage of bole area of all trees greater than 1 inch DBH	High basal area figures across all forest and woodland ecological response units, with a dominance of trees in smaller size classes. High stand density, particularly in small size classes, increases competition between trees, reducing tree vigor and therefore reducing stand resilience to insect and disease; stands would be at a greater wildfire risk.	Lower basal area figures across all forest and woodland ecological response units, with a dominance of trees in larger size classes. Lower stand density and reduced numbers of small-diameter trees, increases available resources, improving growth potential and vigor and improving stand resilience to insect and disease. Reduced tree density helps break up fuel continuity (vertically and horizontally) reducing wildfire risk and catastrophic fire effects.

Resource Element	Indicator/Measure	No Action Alternative Alternative 1	Proposed Action Alternative 2
Forest Structure	Canopy Cover (percent)	Continued dominance of seral stages categorized as closed canopy, with high percent canopy cover relative to desired conditions across all forest and woodland ecological response units. In the event of an unplanned ignition, fire would be transmitted from tree to tree through the canopy, increasing overall tree mortality and increasing potential for stand replacement. Wildfire responders would be limited to indirect suppression tactics.	Shift toward dominance of seral stages categorized as open canopy, with reduced percent canopy cover relative to the existing condition across all forest and woodland ecological response units. In the event of an unplanned ignition, fire would be transmitted on the surface, with limited potential for crown fire initiation except under extreme wind conditions. Wildfire responders could use direct suppression if conditions and access allow them to do so safely.
Forest Structure	Crown base height (feet)	Predominance of low crown base heights due to the dominance of small-diameter trees in immature stands. In the event of an unplanned ignition, fire would be transmitted through ladder fuels from the surface into the crown, increasing overall tree mortality and increasing potential for stand replacement. Wildfire responders would be limited to indirect suppression tactics.	On average there is an increase in crown base height of residual trees across all ecological response units. In the event of an unplanned ignition, fire would remain on the surface, with limited potential for crown fire initiation except under extreme wind conditions. Wildfire responders could use direct suppression if conditions and access allow them to do so safely.
Forest Health and Resiliency	Fuel loading of downed woody fuels (tons/acre).	Continued increase in fuel loading of downed woody fuels above existing levels across all forested and woodland ecological response units. Increasing fuel loading contributes to high wildfire risk and in the event of an unplanned ignition fire intensity is increased. Wildfire responders would be limited to indirect suppression tactics.	Decline in fuel loading across all forested and woodland ecological response units as prescribed burning and restoration treatments are applied. In the event of an unplanned ignition, surface fire intensity is reduced and the potential for transition to crown fire is reduced. Wildfire responders could use direct suppression if conditions and access allow them to do so safely.
Forest Health and Resiliency	Fire Regime Condition Class. Degree of departure from the central tendency of reference conditions. Vegetation Condition Class would be used as a surrogate.	Continued departure from natural fire regimes across all forested and woodland ecological response units. As fire-dependent ecosystems become further departed there is potential for increased uncharacteristic wildfire behavior leading to long-lasting adverse fire effects.	Shift of acres of vegetation communities toward their natural fire regime. As fire-dependent ecosystems become closer aligned with their natural fire regime, acres are less likely to burn with uncharacteristic fire behavior, therefore there are fewer long-lasting adverse fire effects.
Forest Health and Resiliency	Insect and disease risk.	Insect and disease risk would continue to increase across all woodland and forest ecological response units as forest health and vigor continues to decline. As vegetation communities become more susceptible to insect and disease, large areas could undergo high levels of tree mortality, which alters species composition and promotes invasion by nonnative species.	Insect and disease risk is reduced across all woodland and forest ecological response units as treatments are applied that reduce competition, remove suppressed individuals, and improve the overall vigor of residual trees. By improving resilience to insect and disease, large catastrophic outbreaks are prevented.

Resource Element	Indicator/Measure	No Action Alternative Alternative 1	Proposed Action Alternative 2
Wildfire Behavior and Hazard	Crowning Index (miles per hour)	Continued reduction in crowning index as stand densities, ladder fuels, and canopy closure continue to increase in most forest and woodland ecological response units. As crowning indexes decline, crown fire initiation could occur at lower wind speeds and therefore the risk of stand-replacing fires is increased.	Increases in crowning index occur across all forest and woodland ecological response units as treatments are applied to reduce stand density, reduce ladder fuels, and increase canopy spacing. Increased wind speeds would be needed to initiate crown fire, therefore the risk of stand-replacing wildfire is reduced.
Wildfire Behavior and Hazard	Torching Index (miles per hour)	Continued reduction in torching index as surface fuels, fuel loading, and ladder fuels continue to accumulate in most forest and woodland ecological response units. As torching indexes decline, torching and crown fire initiation could occur at lower wind speeds and therefore the risk of stand-replacing fires is increased.	Increases in torching index occur across all forest and woodland ecological response units as treatments are applied to reduce surface fuel loading, ladder fuels, and raise crown base heights. Increased wind speeds would be needed to initiate torching and crown fire, therefore the risk of stand-replacing wildfire is reduced.
Wildfire Behavior and Hazard	Fire Risk Rating	Fire risk continues to grow across all forested and woodland ecological response units, with increased risk of uncharacteristic fire behavior. In the event of an unplanned ignition, some vegetation communities would undergo stand replacement which has long-lasting impacts on species composition and slow recovery of native communities. Wildfire responders would be limited to indirect suppression tactics.	Fire risk declines across all forested and woodland ecological response units, with reduced risk of uncharacteristic fire behavior. In the event of an unplanned ignition, most vegetation communities would undergo less severe fire behavior, with fewer acres impacted by stand-replacing wildfire. Wildfire responders could use direct suppression if conditions and access allow them to do so safely.
All Rare Plant Species Individuals; Direct Effects	Disturbance from project implementation directly causing take of individuals of any given species	None	None
All Rare Plant Species Individuals; Indirect Effects	Disturbance from project to required physical elements of any rare plant species' habitat that results in subsequent take of individuals; damage to soil characteristics, hydrology; would vary among species	Continued degradation of forest environmental health and further decline in habitat conditions for native sensitive plant species	Improved environmental and habitat conditions for sensitive native plant species over the next 20 years
Rare Plant Species Populations	Population Trends; remain static	Rare plant species populations would experience downward trends due to further declines in forest and watershed health	Rare plant species populations would maintain current density and distribution trends or would increase in numbers and geographic areas as forest and watershed health improve over the next 20 years
Soil condition	Fuel loading\Fire Regime Condition Class	No restoration treatments would be implemented; therefore, soil condition would continue to be at risk from the potential threat of wildfire due to the Fire Regime Condition Class that these areas fall within.	The proposed action will result in Fire Regime Condition Class of the ecological response units to trend towards a more natural fire return interval which will limit the potential of a high-severity wildfire and its subsequent impacts within the project area.

Resource Element	Indicator/Measure	No Action Alternative Alternative 1	Proposed Action Alternative 2
Soil condition	Soil stability	No restoration treatments would be implemented; therefore, soil stability would continue to be at risk from the potential threat of wildfire. If a wildfire were to occur, soil erosion and the subsequent sediment increases would potentially have an adverse effect on water quality.	The percentage of the area where moderate to severe erosion potential occurs would not change as a result of the proposed action. However, the proposed action would result in these areas being more resilient to disturbance, such as fire, which would protect these soils from potential erosion issues.
Soil condition	Nutrient cycling	Nutrient cycling would continue to be jeopardize due to the risk of an uncharacteristic wildfire and the current closed canopy. Nutrient cycling would also continue to deteriorate over the long term due to the lack of herbaceous cover, light, and water at the soil surface.	The proposed action would result in long-term direct impacts to the soil nutrient cycle. The proposed action would move the watersheds to a more natural fire return interval, thus protecting the nutrient availability. It is expected that through the implementation that the long-term nutrient cycling would be improved due to the reduction in wildfire potential and the increase in canopy openings that increase light and water to the soil surface, resulting in more herbaceous ground cover.
Watershed condition class	Watershed health	No restoration treatments would be implemented; therefore, the watershed condition class of the watersheds within the project area would not improve and would be at a continued risk from the potential threat of wildfire and insect/disease outbreak.	The proposed action is expected to help the watersheds currently functioning at risk and impaired transition into a proper functioning condition.
Water quantity	Water yield and potential for flooding	No restoration treatments would be implemented under this alternative; therefore, water yield would be maintained at current levels and continue to decrease as the density of the trees on the landscape continues to increase.	Under the proposed action, water yields are expected to increase for up to 5 years following projects that reduce the overstory canopy with no increased risk for flooding.
Water quality	Miles of impaired stream	Since no restoration treatments would be implemented the 30.17 miles of impaired streams would continue to be impaired with additional areas likely to become impaired, especially if an uncharacteristic wildfire occurs within the project area.	Under the proposed action, it is expected that the current reaches of streams that are impaired would be rehabilitated during the 20-year project life. Streams that are currently listed would likely experience improved water quality possibly leading to delisting of some or all of the impaired streams in the project area.
Mexican Spotted Owl	Disturbance to, loss of, or displacement of individuals; disruption of key life behaviors (e.g., breeding, nesting, fledging, roosting, foraging, etc.); changes to habitat suitability or availability; and changes to critical habitat including primary constituent elements	No restoration treatments would be implemented; therefore vegetation trends would continue to cause a decline in the quality of mature, mixed conifer forest habitat for this species.	May Affect, Likely to Adversely Affect
Peñasco least chipmunk	Same as listed for Mexican spotted owl	No restoration treatments would be implemented; therefore vegetation trends would continue to cause a decline in the quality of mature, mixed conifer forest habitat for this species.	May Affect, Not Likely to Adversely Affect

Resource Element	Indicator/Measure	No Action Alternative Alternative 1	Proposed Action Alternative 2
New Mexico meadow jumping mouse	Same as listed for Mexican spotted owl	No restoration treatments would be implemented; therefore vegetation trends would continue to cause a decline in the quality of mature, mixed conifer forest habitat for this species.	May Affect, Not Likely to Adversely Affect
Regional Forester's Sensitive Species	Disturbance to, loss of, or displacement of individuals; and changes to habitat suitability or availability, including habitat size and quality	The no action alternative does not propose necessary treatments needed for sustaining or enhancing sensitive species habitats.	May Impact Individuals, but Not Likely to Cause a trend to Federal Listing or Loss of Viability
Management Indicator Species	Changes in associated habitats suitability or availability; and changes to population trends	No restoration treatments would be implemented; therefore forest and woodland vegetation trends in the project area would continue to degrade habitat quality in these fire-adapted ecosystems.	Some individuals may be impacted, but the majority of the species populations will be maintained and will recover quickly.
Neotropical Migratory Birds	Disturbance to, loss of, or displacement of individuals; disruption of key life behaviors (e.g., breeding, nesting, fledging, roosting, foraging, etc.); changes to habitat suitability or availability; and changes to statewide population trends	No restoration treatments would be implemented; therefore foraging and nesting habitat would continue to be lost due to encroachment by shrubs and trees.	Slight Impacts, will not change population trends
Important Wildlife Game Species	Disturbance to, loss of, or displacement of individuals; and changes to statewide population trends	No restoration treatments would be implemented; therefore forest and woodland vegetation trends in the project area would continue to degrade habitat quality in these fire-adapted ecosystems.	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.
Air Quality	Particulate matter emissions	26,950 to 32,3201 tons from wildfire None from prescribed fire	17,930 to 21,790 tons from wildfire and prescribed fire
Air Quality/Climate Change	CO_2 emissions	3.9 million to 4.9 million tons from wildfire None from prescribed fire	2.9 million to 3.6 million tons from wildfire and prescribed fire
Visibility	Change in visibility	Compromised visibility during wildfire events; potential adverse impacts to Class I areas	Compromised visibility during wildfire events; potential adverse impacts to Class I areas, although fewer than the No Action Alternative
Air Quality	Public health impacts	Smoke impacts could cause health issues during wildfire events, which have an unknown duration	Same as No Action Alternative
Characteristic Landscape	Enhancement of existing landscape character achieved/ changes in scenic attractiveness	Enhancement of existing landscape character would not be achieved. Overly dense growing conditions, and a lack of mature healthy trees and diverse vegetation, would continue the risk for catastrophic wildfire which would have major adverse effects to scenery resources.	The characteristic landscape could be adversely affected in the short term due to the removal of trees and fire treatments. However, the characteristic landscape would be improved in the long term by the creation of more open spaces and views, increases in mature trees and diverse vegetation, and overall improved forest health.

Resource Element	Indicator/Measure	No Action Alternative Alternative 1	Proposed Action Alternative 2
Visual Quality Objectives	Determine whether areas of Retain or Partial Retain classes would be significantly or irreversibly altered. Note there are no Very High (Preserve) acres in the project area.	Areas of Retain or Partial Retain would experience degradation from overly dense growing conditions, lack of mature healthy trees and diverse vegetation, and potential for catastrophic wildfire. The degree of contrast could be strong, especially in areas of wildlife. Visual quality objectives may not be met.	Visual quality objectives of Retain and Partial Retain would be violated in the short term. However the proposed Forest Plan amendment related to scenic quality would allow for violations to achieve long-term restoration goals. Visual quality objectives would be met in the long term because the alterations would be scenically beneficial. Line, form, color, and textures would be consistent with existing health forest areas.
Scenic Benefits	Quality of life and recreation experience/ qualitative discussion about the adverse and beneficial effects of the proposed project on public perception	Quality of life and scenic benefits would remain the same.	There would be short-term adverse impacts to the recreation experience and quality of life in the short term from the drastic changes to the view from burned trees, dying vegetation, equipment, temporary roads, and skid trails. In the long term, scenery would benefit as more open space and views are created, mature trees and diverse vegetation increase, and the overall sense of a healthy forest is experienced.
Recreation Setting	Changes to the existing recreation setting	There would be no impacts to the recreation setting beyond those that are already occurring from current U.S. Forest Service activities; these impacts (including wildfire) are expected to occur at similar frequencies and intensities as they do today.	Some recreation and/or interpretive sites would be targeted for restoration. This could cause temporary (e.g., a single season), site-specific, minor to moderate adverse impacts to the recreation setting. Upon being restored, the recreation setting would likely improve (e.g., become safer, more scenic, and more sustainable for future recreationists), resulting in a long-term, beneficial impact to the recreation setting.
Recreation Opportunities	Changes (loss of or creation of) to the current available recreation opportunities and activities	There would be no impacts to the recreation opportunity beyond those that are already occurring from current U.S. Forest Service activities; these impacts (including wildfire) are expected to occur at similar frequencies and intensities as they do today.	Restoration activities, particularly those that involve heavy equipment or machinery, have the potential to adversely impact recreation opportunities and experiences; these impacts would be site specific and short term. Hunting opportunities (both big and small game) that could be displaced by restoration activities would be minor to moderate impacts, since the areas within the game management unit that are beyond a given restoration activity would remain available for hunting, subject to applicable laws and regulations.
Desired Recreation Experiences	Changes (diminishment or improvement) to existing recreation values and quality	There would be no impacts to the desired future conditions beyond those that are already occurring from current U.S. Forest Service activities; these impacts are (including wildfire) expected to occur at similar frequencies and intensities as they do today.	The desired recreation experiences of the project area would not change, since the restoration methods would be conducted in a manner that minimizes impacts to recreation experiences and in compliance with the Forest Plan. Restoration methods would only preclude recreational desired experiences temporarily during initial work and construction.

Resource Element	Indicator/Measure	No Action Alternative Alternative 1	Proposed Action Alternative 2
Infrastructure	Restoration methods that result in changes to existing infrastructure	Constructed features, utility corridors, and rights-of-way would not change. Constructed features, utility corridors, and rights-of-way may continue to be at high wildfire risk.	Existing constructed features, utility corridors, and rights-of-way would not be precluded under the proposed action. Restoration activities at or near existing infrastructure would be conducted in a manner that maintains the function of the other infrastructure. Temporary road closures would occur in site-specific areas of the existing 360-mile core road system and 168 miles of Motor Vehicle Use Map road systems, resulting in short-term, minor, and adverse impacts. New road construction and existing road reconstruction, maintenance, or rehabilitation would be a minor, localized impact.
Infrastructure	Changes to existing traffic patterns and changes to existing access	Motorists traveling on the 360 miles of core routes and 168 miles of Motor Vehicle Use Map National Forest System routes designated open to public use could experience temporary traffic delays and road closures in areas where immediate risks to motorist safety resulting from current treatments are found or when existing routes need repair work. These effects would occur intermittently across the project area and would continue to be temporary and short term.	Temporary road closures would occur in site-specific areas of the existing 360-mile core road system and 168 miles of Motor Vehicle Use Map road systems, resulting in site-specific, minor impacts to both existing traffic patterns and existing access. New road construction and existing road reconstruction, maintenance, or rehabilitation would be a minor, localized impact. An indirect impact of new roads, whether temporary or permanent, could be the potential for illegal use and user-created route establishment.
Inventoried Roadless Areas	New access roads constructed within inventoried roadless areas	No impact since no roads would be constructed within the inventoried roadless area; in the event of a catastrophic wildfire, suppression activities could temporarily indirectly impact the roadless character that has been identified for the inventoried roadless area (e.g., natural-appearing landscapes with high scenic quality), such as the construction of a dozer fire line.	No impact since no roads would be constructed within the inventoried roadless area; indirect impacts would be the same as under the No Action Alternative.
Inventoried Roadless Area	Changes to the naturalness, undeveloped character, opportunities for solitude, and reduction in size	Fuel loading may increase and the risk of wildfire would correspondingly also increase both within and adjacent to the inventoried roadless area.	Minor, short-term, localized impacts would occur to the naturalness, undeveloped, and outstanding opportunities for solitude qualities of the inventoried roadless area from the presence of workers, smoke from prescribed burns and managing wildland fires, and noise from restoration activities via hand treatments with mechanical tools.

Resource Element	Indicator/Measure	No Action Alternative Alternative 1	Proposed Action Alternative 2
Range	Changes in range conditions	If the historic fire-adapted ecosystems are not maintained and/or restored, the vegetation would decline, including the availability of grasses, forbs, and shrubs for livestock grazing. The overgrown understory would continue to increase, which would elevate the risk of wildfire within grazing allotments over the long term.	Ground disturbance associated with different elements of the proposed action would create a short-term reduction in the amount of forage available for livestock because grasses and forbs would be trampled, burned, and uprooted in some cases. In addition, certain areas within the rangeland allotments would be closed during vegetation thinning implementation which would limit the amount of available forage for livestock, creating adverse short-term effects. Beneficial impacts to rangeland resources would result from prescribed fire treatments over the long term. Forest restoration treatments would reduce tree density and open the forest canopy in many areas, encouraging the growth of native grasses and forbs grazed by livestock.
Heritage	Effects to heritage resources	The lack of forest restoration treatments under the No Action alternative would not directly impact heritage resources. However, the trend toward increased fuel loading and tree mortality from insects and disease would continue; thereby increasing the risk of wildfire events, which can be detrimental for heritage resources with structural features, particularly those resources with flammable features.	Proposed action would help to reduce the fuel loading within and near heritage resources and would help to reduce the intensity of wildfires.
Economics	Treatment costs	None	$19,562,400 to $76,153,400
Economics	Timber value	None	$751,739 over 20 years
Economics	Total production of forest products	None	230,197 CCF over 20 years (CCF = 100 cubic feet)
Economics	Potential jobs created	None	75 to 200 annually
Economics	Wildfire exposure costs	$74,467,200	$37,248,000
Environmental Justice	Impacts to minority and low-income communities	None	None

Chapter 3 Affected Environment and Environmental Consequences

This chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing both alternatives, Alternative 1 – No Action Alternative and Alternative 2 – Proposed Action, 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. The specialist reports are saved in the project file. As required by the 40 CFR 1502.14, each resource specialist report provides an explanation of the analysis methodology that was used in drawing the effects analysis.

3.1 Introduction

The Affected Environment is discussed by resource, in order to facilitate the readers' understanding of the context of the Environmental Consequences that follow. The National Environmental Policy Act (NEPA) requires the analysis and disclosure of direct, indirect, and cumulative effects on the affected environment. Environmental consequences are interchangeable with effects. Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (Council on Environmental Quality 2007). The analysis of these anticipated effects provides a basis for comparing alternatives and a method by which the interdisciplinary team, the public, and the responsible official can assess the consequences through time and in a particular geographic area.

To help inform the environmental consequences for some of the resources discussed below, scenario projections for vegetation growth, development, management, natural disturbance, and some cumulative effects for the South Sacramento Restoration Project Area were completed using state and transition models developed as part of the Integrated Landscape Assessment Project. The Integrated Landscape Assessment Project was designed to support ecosystem management planning and assessments across all forests, woodlands, and arid lands of New Mexico, Arizona, Oregon, and Washington. The project explored the dynamics of broad scale, multi-ownership, vegetated landscapes by integrating information about current and future vegetation and fuel conditions, climate change, wildlife habitat, fuel treatment economics, and community economics (Burcsu and others 2014). State and transition models were used by the integrated landscape assessment project effort to represent the range of vegetation types from forested to arid lands and project changes from vegetation community development, natural disturbances, and management events. Burcsu and others (2014) describe the individual state classes (boxes) within integrated landscape assessment project state and transition models as representing *cover types*, usually the dominant species or vegetation assemblage, and *structural stages*, based on physical attributes such as vegetation height, percent cover, and canopy layers. The transitions (arrows) in the state and transitional models simulated successional processes such as growth and development, natural disturbances such as wildfire and insect outbreaks, and management actions such as prescribed wildfire and tree harvesting (Burcsu and others 2014).

To link these abstract state and transition model states to current landscape conditions, spatial data representing current vegetation conditions were used. The spatial area in each of the current vegetation's discrete classes (of cover type and structure) allocated area by modeling strata into the various states within a model, forming the modeling initial conditions. These initial conditions provided the starting point from which state and transition model projections began.

Additional details about the Integrated Landscape Assessment Project and how it was used to inform this environmental impact statement can be found in the project record.

3.1.1 Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

A cumulative impact or effect is a project-induced impact that, when added to the effects of other past, present, and reasonably foreseeable future actions, results in an incremental effect on the resource. Individually minor actions can become collectively more significant taking place over a longer period of time. Cumulative effects are discussed in terms of changes in the existing condition due to present and foreseeable activities, including the effects of the alternative being discussed. The spatial context being considered for cumulative effects differs by resource area, as explained in the individual cumulative effects sections.

Table 3-1 lists those federal and non-federal actions that would have cumulative impacts to resources within the study area.

Table 3-1. Actions that May Have Cumulative Impacts to Resources within the Study Area

Action	Summary of Action
Wildland Fire Management	Both federal and state agencies conduct wildland fire management activities that could cumulatively impact vegetation, general wildlife, and special status species habitat.
Nonnative Invasive Species Management	Nonnative invasive species management can be conducted by federal, state, and local entities as well as private landowners. Management activities can include non-treatment elements (prevention, education, inventory, monitoring, and cooperative partnership strategies) as well as treatment options that include manual, mechanical, biological, and chemical methods.
Westside Sacramento Mountains Watershed Restoration and Fuels Reduction Project – Priority Areas 1 and 2 Environmental Assessment Sacramento Ranger District Decision signed: 7/18/2017	The proposed action uses a combination of mechanical thinning and prescribed fire on approximately 3,206 acres of National Forest System lands in order to reduce the threat of high-intensity wildfires and promote healthy watersheds.
Westside Sacramento Mountains Watershed Restoration and Fuels Reduction Project – Priority Area 3 Environmental Assessment Sacramento Ranger District Decision signed: 03/22/2018	The Westside Watershed Project uses a combination of mechanical thinning and prescribed fire on approximately 3,439 acres of National Forest System and City of Alamogordo lands in order to reduce the threat of high-intensity wildfires and promote healthy watersheds
Jim Lewis Fuels Reduction Project Decision signed: 9/1/2010	The Jim Lewis Fuels Reduction Project includes various restoration treatments on 37,333 acres in the south-central portion of the Sacramento Ranger District. The project includes 6,250 acres of commercial thinning; 13,000 of pre-commercial thinning followed by piling on up to 19,550 acres; 5 miles of road relocation; goat grazing on up to 700 acres to manage oak; and aspen restoration that included constructing fences and/or other barriers on up to 1,000 acres. Initial treatments were completed in 2017.

Action	Summary of Action
Two Goats Forest Restoration Project Decision signed: 11/6/2009	The Two Goats forest restoration project has included mastication, commercial timber, and fuelwood sales, and restoration activities on 5,346 acres. Project implementation began in 2014. Initial treatments on all 5,346 acres were completed in 2017.
Rio Peñasco II Project Decision signed: 12/06/2002	Commercial thinning, pre-commercial thinning, and prescribed burning of vegetation slash on approximately 4,347 acres over a 5-year period. Ten miles of temporary roads would be constructed to implement the project. Upon project completion, temporary roads are scarified, seeded, and closed. The Supplemental Report added 300 acres of commercial and pre-commercial thinning.
Mescalero Apache Tribe Thinning and Burning Treatments	The Mescalero Apache Tribe conducts vegetation treatments that could cumulatively impact vegetation, general wildlife, and special status species habitat. On average, the tribe burns between 500 to 1,000 acres per year, conducts forest thinning projects on approximately 1,000 acres per year, and conducts commercial logging on approximately 500 acres per year.
Sacramento Foothills Habitat Improvement Prescribed Fire Project Bureau of Land Management Las Cruces District Office	The project is located approximately 25 miles southeast of Alamogordo, New Mexico, on lands managed by the Bureau of Land Management and Fort Bliss. Based on available mapping, approximately 10,000 acres are proposed for prescribed burning, and are identified in five units. Hand-held drip torches would be used to ignite two of the five units proposed for prescribed burning. The interior would be ignited by helicopter areal ignitions. Prescribed fires are projected to take place during late winter or spring seasons within the years of 2018 through 2021.

3.2 Vegetation Communities and Fire and Fuels

The vegetation communities and fire and fuels specialist report (U.S. Forest Service 2018a) is incorporated by reference. See the report for detailed information about data sources, methodology, assumptions, and limitations.

3.2.1 Affected Environment

The description of the Affected Environment for many of the forest vegetation characteristics is provided in detail in the Vegetation Communities and Fire and Fuels Report (U.S. Forest Service 2018a) and in Section 1.4.1. Existing and Desired Conditions, in Chapter 1. That information is summarized below.

Vegetation Community Composition

There are a number of vegetation community classifications for North America and the American Southwest (Bailey 1995; Brown and Lowe 1980; Daubenmire and Daubenmire 1968; Southwestern Regional Gap Analysis Project, National Vegetation Classification Standard [Federal Geographic Data Committee 2008]), and those vegetation community classifications along with other environmental features are used to further classify geographic regions as ecoregions, based largely on vegetation and climate (Environmental EPA Ecoregions, Nature Serve Ecological Systems [Comer and others 2003]). Forests and woodlands of the Southwest are usually classified into vegetation communities based on the presence of dominant tree species; e.g., pinyon-juniper, ponderosa pine, and mixed conifer. Dick-Peddie (1993) provides detailed descriptions of New Mexico vegetation communities or types, including fine spatial-scale vegetation types and various species-dominated series, detailed listings of species, and discussions of ecological or plant succession for each vegetation type.

Ecological Response Units

Ecological response units are generally described as vegetative communities. These units represent an ecosystem stratification based on vegetation characteristics that would occur when natural disturbance regimes and biological processes prevail and combine potential vegetation and historical fire regimes to form ecosystem classes useful for landscape assessment (U.S. Forest Service 2014b). The numerically and physically dominant plant species that are used to identify each ecological response unit in the project area are described by Wahlberg and others (2014). Ecological response unit descriptions include characteristics of 1) descriptions of plant species compositions, 2) reference conditions; successional (seral) stages present, coarse woody debris, fire regime, and patch size, 3) contemporary seral states, 4) computed values for contemporary model states, and 5) biomass present. Ecological response units also are similar to the biophysical characteristics of LANDFIRE landscape classifications and vegetation succession that are used to indicate wildfire fuels and fire behavior (Rollins 2009). Ecological response units combine the characteristics of site fire potentials along with historic fire regimes. Table 1-7 lists the ecological response units within the project area and associated seral and climax species. Figure 1-5 shows the spatial distribution of ecological response units across the project area.

Forest Structure

Forest structure affects the distribution, density, and composition of surface and canopy fuels, which affects the behavior of fire and, ultimately, post-fire forest structure. It also affects important forest health variables. Forest structure and density are described using a number of metrics, as outlined below.

Plant Succession

The plant species compositions and physical structure of ecological response units change over time following major disturbances such as wildfire or other significant tree die-off. Plant community succession (also called ecological succession) and descriptions of seral stages are used to characterize the ecological response units over time, relative to vegetation recovery from environmental disturbance (see Dick-Peddie 1993). Plant succession is the change in dominant plant species composition over time following a disturbance that removes most of the existing plants from a given landscape area.

Vegetative Structural Stage

Vegetative structural stage is a classification of fine-scale forest structural development, where the structural stages result from environmental disturbance and subsequent plant succession. Forests are classified into six separate classes based on successional stage and diameter size classes, from Vegetative Structural Stage 1 Grass-Forb/Shrub to Vegetative Structural Stage 6 Old-Growth Forest (Figure 3-1). The vegetative structural stage classification is included in this analysis because it is specific to Northern Goshawk Habitat Management Plan (Reynolds and others 1992) requirements and was incorporated into the Forest Plan.

Trees per Acre

Trees per acre is a count of the total number of trees, usually over a certain minimum size, on 1 acre.

Basal Area

Basal area is used to describe the average amount of an area occupied by tree stems at breast height (4.5 feet from the ground) and is measured in square feet per acre.

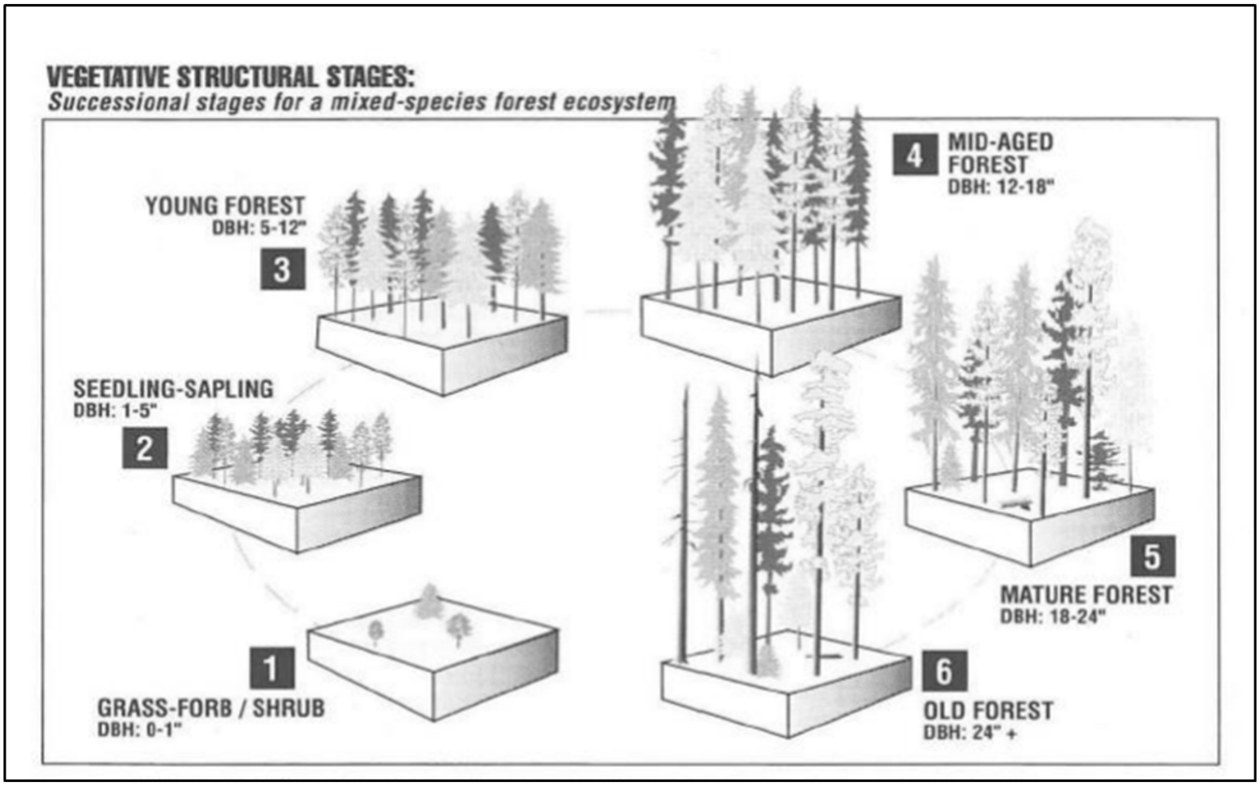

Figure 3-1. The Vegetative Structural Stage classification of succession in a mixed species forest ecosystem. (An ecological disturbance such as high-severity wildfire or mature tree die-back from other causes resets the succession process from stage 6 to stage 1.)

Canopy Cover Percentage

Canopy cover is the horizontal fraction of the ground that is covered directly overhead by tree canopy, the percent of vertically projected canopy cover in the group, patch, or stand (Scott and Reinhardt 2005). When historically low-density forests become overcrowded, tree crowns may merge and form a closed canopy. Tree canopies are the primary fuel layer in a forest crown fire (U.S. Forest Service 2003a).

Crown Base Height

Crown base height is the vertical distance between the ground surface and the base of the live crown fuels sufficient to propagate fire vertically into the canopy (Scott and Reinhardt 2001), but in practice should incorporate the presence or effect of “ladder” fuels (Van Wagner 1993). Ladder fuels are the smaller trees, shrubs, and low branches that have the potential to carry a surface fire up into the tree crowns. Reducing ladder fuels can mitigate the potential for crown fires to initiate (Van Wagner 1977).

A description of forest structure, by ecological response unit, is provided in the Environmental Consequences section below for a concise comparison of forest structure conditions in year 0 (current conditions), after 20 years under the no action alternative, and after 20 years of treatment under the proposed action.

Old Growth

Old-growth forests are groups and patches of old trees with high coarse woody debris elements such as large snags and downed logs. Old-growth patches in the project area are generally where historic timber harvest, insects, diseases, and/or wildfire have not killed or removed old trees. Such old-growth patches provide many ecosystem services—plant and animal habitat, carbon sequestration, hydrologic function, aesthetics, and spiritual values. Essential structural features of old growth are described in Table 1-2, in Chapter 1.

Old-growth allocations are based on current conditions within the project area along with Forest Plan–specific management direction (U.S. Forest Service 1986a). Most sites currently do not fully meet the minimum criteria for old-growth conditions as listed in the current Forest Plan. Vegetation communities with a large tree component are very rare within the project area, making up less than 1.5 percent of the mixed conifer and ponderosa pine ecological response units. At least 20 percent of each forest type must be managed for old-growth characteristics across the entire Lincoln National Forest (U.S. Forest Service 1986a). The project would be designed to develop old-growth conditions over the 20-year project period, that would contribute to this Forest Plan standard. See Table 1-4 in Chapter 1 for proposed old-growth allocation of approximately 54,776 acres within the South Sacramento Restoration Project.

Mature and old forest classes currently only compose 3.5 percent of the total forest and woodland states. Mixed-Conifer with Aspen only has 212 acres (0.8 percent), Mixed-Conifer Frequent Fire only has 316 acres (0.6 percent), Ponderosa Pine Forest has only 36 acres (0.3 percent) and Pinyon-Juniper Woodlands has 3,465 acres (21 percent).

Forest Health and Resiliency

Fuels and Fuel Loading

Fuels is the term given to vegetation that is available for combustion. Fuels are often grouped into the general categories of grass, shrubs, and timber. For modeling fire behavior, fuels are further categorized into fuel models based on characteristics such as fuel bed depth, surface area to volume ratio, and the amount of fuel loading in an area. Surface fuels include litter, duff, and coarse woody debris greater than 3 inches in diameter. Surface fuel loading (quantities) influences fire behavior. High surface fuel loading can result in high-severity fire effects because they can smolder in place for long periods, transferring more heat into soils and tree stems. Reduction of surface fuels reduces fire intensity and severity.

The most dominant fuel models in the project area are classified using Scott and Burgan's 40 fuel modelsas *timber litter* models (Scott and Burgan 2005) (see Figure 3-2.).

Timber litter fuel models are accumulations on the surface of needles, twigs, and branches. Because of the shade from canopy closure, grasses and forbs are scarce. A small portion of the project area has *grass models,* surface fuels consisting of grasses and forbs.

The general classification of fuels is by fire-carrying fuel type (Scott and Burgan 2005):

a) (NB) Nonburnable
b) (GR) Grass
c) (GS) Grass-Shrub
d) (SH) Shrub
e) (TU) Timber-Understory
f) (TL) Timber-Litter
g) (SB) Slash-Blowdown

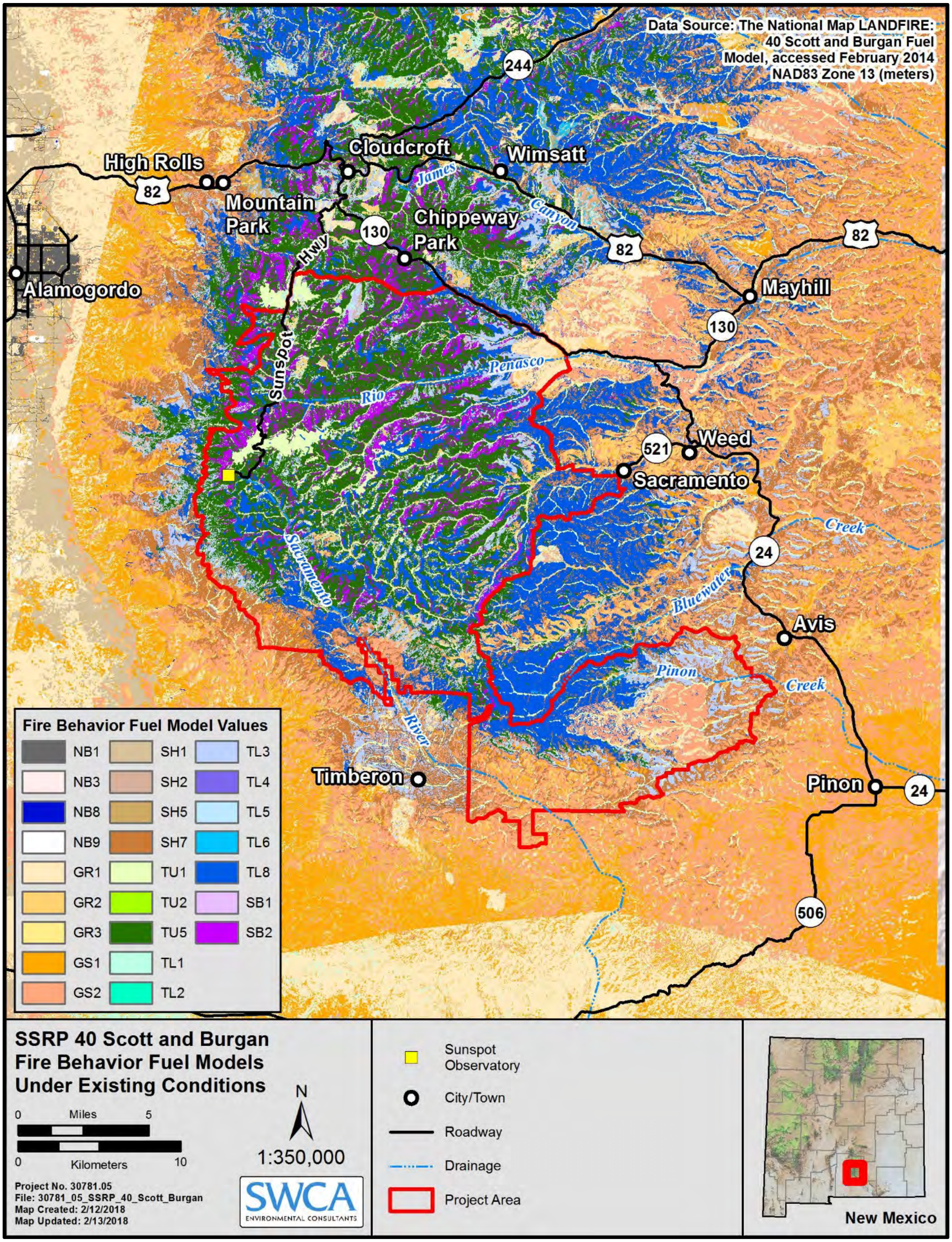

Figure 3-2. Existing fire behavior fuel models for the South Sacramento Restoration Project Area.

Fire Regime

A natural, or historical, fire regime is a general classification describing the role fire would play throughout a landscape in the absence of modern human intervention but includes the influence of burning by Native American groups (Agee 1993).

Fire regime classes are based on the average number of years between fires (also known as fire frequency or fire return interval), combined with the severity (i.e., the amount of vegetation replacement) of the fire and its effect on the dominant overstory vegetation (Hann and others 2008).

The five fire regime classes are:

- Fire Regime I: Frequency of 0 to 35 years and low (mostly surface fires) to mixed severity (less than 75 percent of the dominant overstory vegetation is replaced).
- Fire Regime II: Frequency of 0 to 35 years and high severity (more than 75 percent of the dominant overstory vegetation is replaced).
- Fire Regime III: Frequency of 35 to 200+ years and mixed severity (less than 75 percent of the dominant overstory vegetation is replaced).
- Fire Regime IV: Frequency of 35 to 200+ years and high severity (more than 75 percent of the dominant overstory vegetation is replaced).
- Fire Regime V: Frequency of 200+ years and high severity (more than 75 percent of the dominant overstory vegetation is replaced).

Fire Regime Condition Class

Natural fire regime reference conditions have been developed for vegetation-fuel class composition, fire frequency, and fire severity in biophysical settings at a landscape level for most parts of the United States (Hann and others 2008). The Fire Regime Condition Class is a measure of the degree of departure from reference conditions. Several factors, such as fire suppression, timber harvesting, livestock overgrazing, introduction and establishment of nonnative species, introduced disease and insects, and other management activities, are all possible causes of this departure from historical conditions (Hann and others 2008).

The three Fire Regime Condition Class rankings are:

a) FRCC 1: No or low departure from the central tendency of the reference conditions.

b) FRCC 2: Moderate departure from the central tendency of the reference conditions.

c) FRCC 3: Extreme departure from the central tendency of the reference conditions.

Areas that fall within Condition Class 1 have fire regimes that are within the natural or historical range and are at low risk of losing key ecosystem components. Vegetation attributes (composition and structure) are well intact and functioning properly. Class 2 areas have fire regimes that have been moderately altered and may have departed by one or more return intervals (either increased or decreased). This departure may result in moderate changes in fire and vegetation attributes. Lastly, Class 3 areas have fire regimes that are substantially departed by multiple return intervals. Areas in Class 3 that experience fire have the potential to result in dramatic changes in fire size, fire intensity and severity, and landscape pattern. Overall, this is another tool that can help guide management objectives and set priorities for treatments and can show the urgent need for forest restoration to reduce the high fire hazard risk throughout the project area in order to build sustainability and resilience. Table 1-6 in Chapter 1 summarizes the existing fire regime, forest structure, and Fire Regime Condition Classes for the project area.

Insect and Disease Risk

A number of insects, parasites, and pathogens are impacting the montane forests of the Southwest, including native species of bark beetles (Scolytidae and *Dendroctonus*), defoliating insects, dwarf mistletoes (*Arceuthobium*), and root decay fungi (Dahms and Geils 1997). Some outbreaks if persistent reduce tree vigor and can cause mortality. In some high-elevation areas, the spruce and fir canopy has died as a result of insect outbreaks that are likely tied to recent climate change (Margolis and others 2007).

A number of species of bark beetle occur in low numbers in different tree species, often persisting in stressed living trees or freshly fallen trees. Small infestations only occasionally result in tree deaths, but larger outbreaks occur periodically and are heightened during periods of drought, often causing high mortality rates among larger, older, stressed trees. Western spruce budworm (*Choristoneura freemani*) is a defoliating insect that primarily impacts understory white fir (*Abies concolor*) and Douglas-fir (*Pseudotsuga menziesii*) in the Southwest, and western tent caterpillar (*Malacosoma californicum*) affects aspen (*Populus* spp.). Dwarf mistletoes occur on most conifers and increase the likelihood and impacts of insect outbreaks and fire. Root decay fungi are widespread, weakening trees and thereby increasing the chances of bark beetle infestation (Margolis and others 2007).

Projected insect and disease risk was developed for the project area by the Region 3 Forest Health Program team. State conditions were categorized for each ecological response unit by:

a) Whether vegetation in this seral state would (or would not) be susceptible to insect and disease driven mortality (if not, risk is low); and

b) If vegetation would be impacted, how likely this might be (susceptible states were classified into either moderate or high risk categories).

Classifications were developed using knowledge of the insect species and diseases that impact trees in each ecological response unit, and the biology of these species, using insights about whether those agents typically use smaller or larger trees, in more open or closed states.

Nonnative Invasive Species

There are many species of nonnative invasive plants that occur in the Sacramento Mountains and the surrounding region, which could be introduced and become established following project actions that disturb soil surfaces. Some of the more common invasive weed species include musk thistle (*Carduus nutans*), bull thistle (*Cirsium vulgare*), and teasel (*Dipsacus sylvestris*).

Executive Order 13112, as amended by Executive Order 13751, Forest Service Manual 2900, and the Lincoln National Forest Land and Resource Management Plan (Forest Plan), provide direction related to the management of invasive species. Executive Orders 13112 and 13751 direct federal agencies to prevent and control invasive species and to minimize their economic, ecological, and human health impacts. The order provides for restoration of native species and habitat conditions in ecosystems that have been invaded by nonnative invasive species. A list of species that may occur on the Lincoln National Forest is provided in Appendix B. To comply with Executive Order 13112 and Amendment 13751, and to serve as good stewards of the land, management targets any nonnative invasive plant species that are found to colonize soils disturbed by project actions, with the management objectives of containing and controlling any local infestations. In many cases, techniques to manage noxious weeds can also be used against other nonnative invasive plant species.

Wildfire Behavior and Hazard

Although past and ongoing fuel treatments have been implemented in or near high fire risk areas in the project area, much of the landscape is still vulnerable to uncharacteristic wildfire effects and the associated post-fire effects such as flooding, increased erosion, nonnative plant species infestations, and damaged infrastructure.

Several variables affect fire behavior on a site and over a landscape. Besides weather and terrain, the variables that play the largest role in influencing fire behavior within a forest include dead and live fuel loadings, fuel moistures, crown bulk density (the volume of fuel available in tree crowns), crown base height (the height at which tree branches can be ignited by surface fire), and forest canopy closure (percentage of surface area vertically shaded by overhead foliage) (Agee and Skinner 2005).

Crowning Index

Crown fires have the ability to produce 75 to 100 percent mortality in the forest ecological response units within the project area by consuming the tree crowns. The potential for crown fire to occur is usually expressed in the wind speed (miles per hour) that is necessary for fires to move from crown to crown. This wind speed is referred to as the Crowning Index. Risk of canopy fire under current conditions, as expressed by Crowning Index, has greatly increased from the desired conditions. Under the desired conditions, only 14 percent of the forested landscape would be vulnerable to crown fire with wind speeds as low as 20 miles per hour, while the current estimate is 60 percent of the forested landscape is currently vulnerable to crown fire with wind speeds as low as 20 miles per hour.

Torching Index

A torching fire is a fire burning principally as a surface fire that intermittently ignites, torching the crowns of trees or shrubs as it advances. The Torching Index is the open (6.1-meter) wind speed at which crown fire activity can initiate for the specified fire environment (Scott and Reinhardt 2001).

Wildfire Risk

Wildfire Risk is defined as the chance of a fire starting as determined by the presence and activity of causative agents (National Wildfire Coordinating Group 1998). Wildfire Risk in this analysis is based upon the recent historical record of fire occurrence and the predicted wildfire severity, which is categorized in the Integrated Landscape Analysis Project into non-lethal, mixed severity, and stand replacement fire. Non-lethal fire is defined in the Integrated Landscape Analysis Project as less than 25 percent of the trees are top killed; mixed severity fire is defined as 25 to 75 is top killed; and, stand replacement is defined as greater than 75 percent of the trees are top killed. Stand replacement is further broken down (when appropriate) into characteristic or uncharacteristic.

Community Values at Risk

The Otero County Community Wildfire Protection Plan (SWCA Environmental Consultants 2014) addressed wildfire hazards to communities in the county, which included the project area.

The Community Wildfire Protection Plan identified that Otero County is under significant threat of catastrophic wildfire. The Community Wildfire Protection Plan risk assessment, which uses fire behavior modeling based on fuel, topography, and weather data, found the highest risk areas to be in the higher-elevation forested region of the county, including much of the Sacramento Ranger District (Figure 3-3).

Fire behavior parameters, including flame length, fireline intensity, rate of spread, and crown fire potential are used to determine the risk that wildfire poses to life and property throughout the Community Wildfire Protection Plan project area (see Figure 7 through Figure 10 in the Vegetation Communities and Fire and Fuels Report, U.S. Forest Service 2018a). These fire behavior parameters exhibit extreme and high fire behavior within the project boundary under existing conditions.
The communities of Cloudcroft, Timberon, and Sunspot are located adjacent to the project area, and are just three of the nine communities that are rated as extreme/high risk from wildfire in the Community Wildfire Protection Plan (see Figure 3-3). The Community Wildfire Protection Plan wildland-urban interface extends inside the project boundary (see Figure 3-3), highlighting the importance of fuel treatments that reduce wildfire risk and hazard to these wildland-urban interface communities.

The Otero County Community Wildfire Protection Plan identifies critical infrastructure and community values that are at risk from wildfire (see Figure 11 and Figure 12 in the Vegetation Communities, Fire and Fuels Report, U.S. Forest Service 2018a). Recommendations for fuel treatments and fire prevention in the Community Wildfire Protection Plan identify critical infrastructure and the protection of natural and cultural resources, as priority areas for treatment and mitigation actions. Actions to protect at-risk communities within the wildland-urban interface form the basis of the Community Wildfire Protection Plan and were supported by the local population and key stakeholders throughout the County.

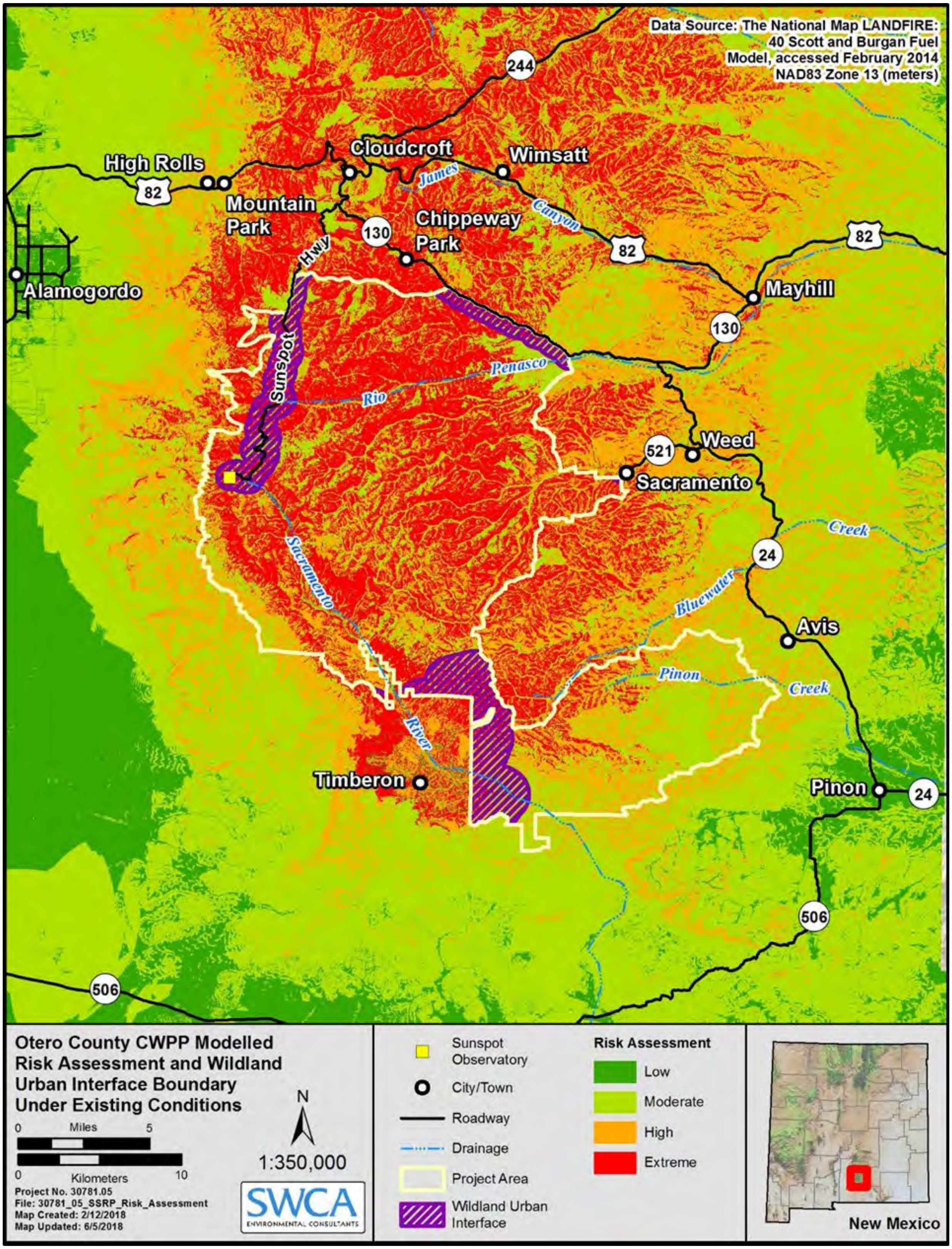

Figure 3-3. Communities at risk adjacent to the South Sacramento Restoration Project Area, Overlaid on the Otero County Community Wildfire Protection Plan Risk and Hazard Assessment.

Climate Change Vulnerability Assessment

A climate change vulnerability assessment for forests across the Southwest concluded that natural vegetation communities across forest lands of the Southwest, and specifically within the Lincoln National Forest, have moderate to very high vulnerability (i.e., ecologically adverse reactions) to forecast climate change (Figure 3-4.) (Triepke and others 2014; U.S. Forest Service 2017c).

While directly combating climate-induced environmental stress is beyond the resources of the Lincoln National Forest, evaluating impacts on resources and landscape within the project area and using management actions to mitigate for those impacts are valid management issues/endeavors. For example, vegetation communities may experience altered ranges; this is of particular concern with regard to nonnative, invasive species, which may be able to take advantage as habitat becomes compromised.

Alternatives that improve the Lincoln National Forest's ability to actively manage natural resource conditions, such as the use of active fire management under the proposed action, would be expected to provide greater beneficial impacts that counteract the effects of changing climate, compared with the no action alternative, which provides less flexibility in managing natural resource conditions.

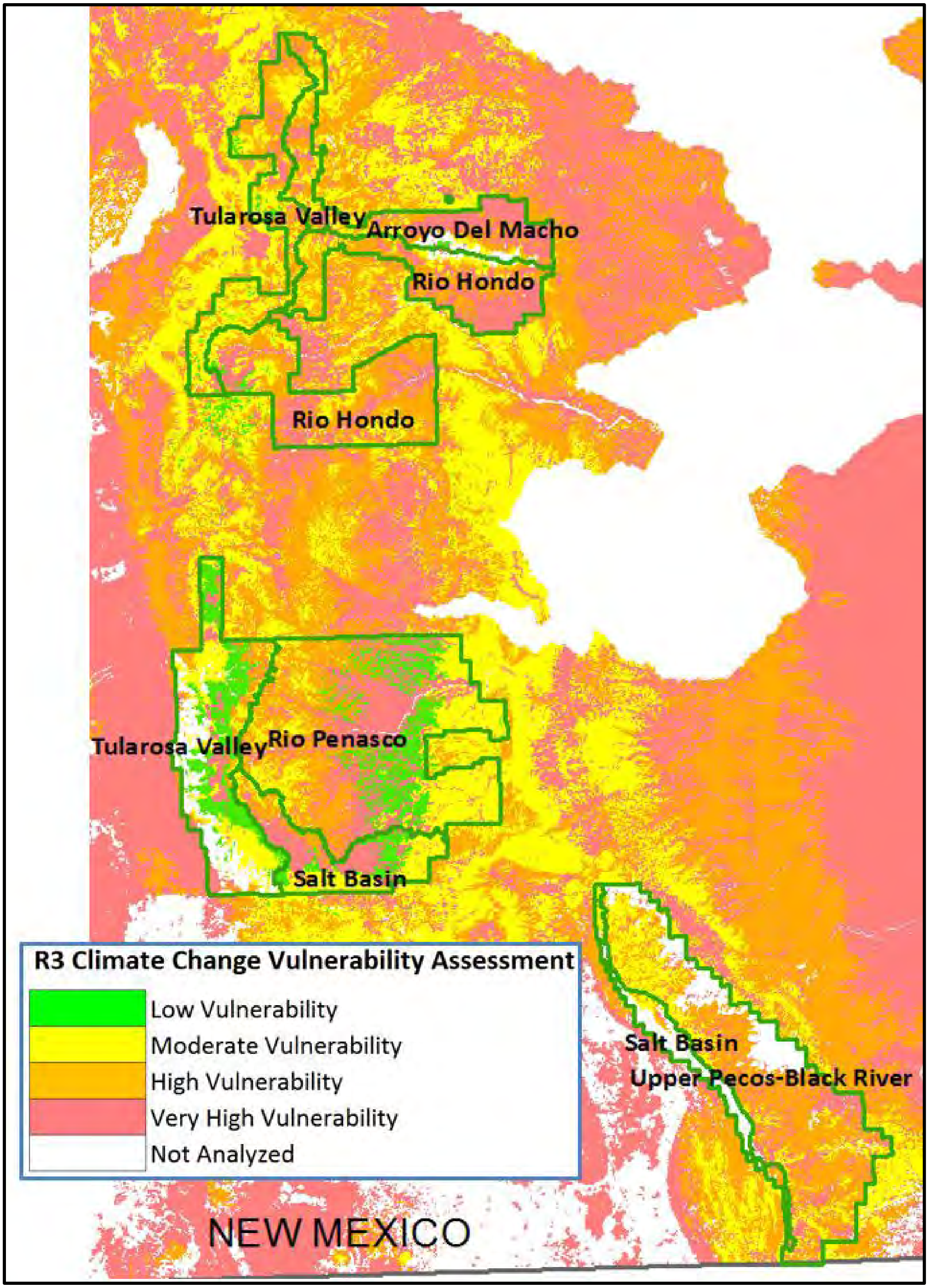

Figure 3-4. Climate change vulnerability assessment results for the Lincoln National Forest (U.S. Forest Service 2017c).

3.2.2 Methodology and Assumptions Used for Analysis

The resource indicators and measures used to analyze the impact of the alternatives on forest vegetation characteristics are listed in Table 3-2.

Table 3-2. Resource Indicators and Measures for Assessing Effects

Resource Element	Resource Indicator	Measure	Used to Address: Purpose and Need, or Key Issue?	Source
Vegetation Community Composition	Vegetation communities or ecological response units; represented by all seral stages and tree density conditions, including old growth, and native and nonnative plant species.	Total acreage of any ecological response unit within the project area no longer supporting the plant species composition and physical structure that define any given ecological response unit.	Yes	Ecological response unit mapping, Lincoln National Forest, Integrated Landscape Assessment Project; Wahlberg and others (2014), Dick-Peddie (1993)
Vegetation Community Composition	Nonnative plant species composition	Nonnative plant species: Acres occupied by any nonnative invasive plant species within any land area of project-created soil surface disturbance. Post-action monitoring would be required.	Yes	Federal Executive Order 13112 and amendment 13751, New Mexico Department of Agriculture (2016), Whitson (1992), Lincoln National Forest
Forest Structure	Stand Structure (Ecological Response Unit State)	Vegetative structural stage	Yes	Integrated Landscape Assessment Project
Forest Structure	Stand Structure (Ecological Response Unit State)	Trees per acre	Yes	Integrated Landscape Assessment Project
Forest Structure	Stand Structure (Ecological Response Unit State)	Basal area: Total combined square footage of all trees greater than 1 inch diameter at breast height	Yes	Integrated Landscape Assessment Project
Forest Structure	Stand Structure (Ecological Response Unit State)	Canopy Cover (percent)	Yes	Integrated Landscape Assessment Project
Forest Structure	Stand Structure (Ecological Response Unit State)	Crown Base Height (feet)		Integrated Landscape Assessment Project
Forest Health and Resiliency	Hazardous fuels (fuel loading)	Fuel loading of downed woody fuels (tons/acre)	Yes	Integrated Landscape Assessment Project
Forest Health and Resiliency	Fire Regime	Fire Regime Condition Class. Degree of departure from the central tendency of reference conditions	Yes	LANDFIRE
Forest Health and Resiliency	Insect and Disease	Insect and disease risk	Yes	Region 3 Forest Health Program team
Wildfire Behavior and Hazard	Wildfire Behavior Parameters	Crowning Index (miles per hour)	Yes	Integrated Landscape Assessment Project
Wildfire Behavior and Hazard	Wildfire Behavior Parameters	Torching Index (miles per hour)	Yes	Integrated Landscape Assessment Project
Wildfire Behavior and Hazard	Wildfire Behavior Parameters	Fire Risk Rating	Yes	Integrated Landscape Assessment Project
Wildfire Behavior and Hazard	Wildfire Risk	Values at Risk	Yes	Otero County Community Wildfire Protection Plan

3.2.3 Integrated Landscape Assessment Project

Scenario projections for vegetation growth, development, management, natural disturbance, and some cumulative effects for the project area were done using state and transition models developed as part of the Integrated Landscape Assessment Project (ILAP).[1] A detailed description of the integrated landscape assessment project methodology and project scenarios is included in Appendix A of the Vegetation Communities, Fire and Fuels Report (U.S. Forest Service 2018a). Appendix A of the Vegetation Communities, Fire and Fuels Report also includes data from a climate change scenario that projects a 10-fold increase in wildfire across the landscape after 20 years of no action and proposed action.

LANDFIRE

LANDFIRE is a national remote-sensing project that provides land managers a data source for all inputs needed for FARSITE, FlamMap, and other fire behavior models.

Fuel Model Classification

The fuels in the planning area are classified using Scott and Burgan’s (2005) Standard Fire Behavior Fuel Model classification system, described in detail above under the Affected Environment.

Fire Regimes

Fire regimes and condition classes were used to help describe the existing ecological health and condition of the project area in relation to the historical role of fire in the project areas.

Information Sources

The following information sources were used to develop this report:

1. Data provided by Forest Service staff at the Sacramento Ranger District, Lincoln National Forest, and Southwestern Region formed the basis of much of the analysis.
2. Ecological response unit and vegetation community data were described using Wahlberg and others (2014), Dick-Peddie (1993), Prior-Magee (2007), and New Mexico Crucial Habitat Assessment Tool (New Mexico Department of Game and Fish and others 2017).
3. The U.S. Department of Agriculture federal noxious weed list (U.S. Department of Agriculture 2017a, 2017b), and list of species that may occur on the Lincoln National Forest (see Appendix B) were used as the primary sources for names of nonnative invasive plant species that may be within, or may be introduced to, the project from surrounding landscapes. The primary reference for information on the ecologies of nonnative invasive plant species is Whitson (1992).
4. A recent climate change vulnerability analysis for forests of the Southwest (Triepke and others 2014), and for forests specifically of the Lincoln National Forest (U.S. Forest Service 2017c), present the predicted impacts of climate change to the project area over the next 20 years (see Figure 3-4).
5. The Otero County Community Wildfire Protection Plan was the source for fire behavior modelling data and community value at risk data for the project area.
6. LANDFIRE was the primary source for fuel modelling and fire regime condition class data.

Numerous other scientific papers also informed the analysis.

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[1] Available at: http://inr.oregonstate.edu/ilap.

Incomplete or Unavailable Information

Characterization of the affected environment for the analysis area is based on the best available information.

During the implementation phase of the project, fire behavior modelling, using Flammap, FARSITE, and the Wildland Fire Decision Support System, would be used to optimize fuel treatment effectiveness for reducing hazardous fuels. These models would be used to determine fire behavior parameters such as flame length, fireline intensity, rate of spread, and crown fire potential under a 20-year treatment projection.

No fieldwork was completed as part of this analysis.

3.2.4 Environmental Consequences

Effects Common to No Action and Proposed Action Alternatives

Alternative A – No Action

Vegetation Thinning Impacts

The following impacts would result from the absence of mechanical and manual treatments for vegetation thinning:

- Restoration and maintenance of native woodlands and forests would not occur.
  Key compositional and structural elements of forest stands would not be restored and ecological resistance and resiliency to environmental disturbance would be limited. Conifer forests would continue to exhibit overgrown and unnaturally high densities of small size-class trees. Stands would continue to be vulnerable to impacts of warmer temperatures and decreased precipitation resulting from climate change (Allen and others 2010; Gutzler 2013; Gutzler and Robbins 2011; Llewellyn and Vaddey 2013; Seager and others 2008) as well as more frequent insect and disease outbreaks; overall forest health would decline.

- Increased incidences of insect and disease resulting from increasing tree physiological stress could alter landscape spatial composition of all ecological response units. Under projected climate change forecasts, the natural range of variability for each ecological response unit may not be sustainable in the long term (Fulé 2008), and with atypical disturbances like large-scale insect and disease, changes to the composition of the ecological response unit may be irreversible or permanent.

- Vegetation communities that are adapted to and maintained by frequent low-severity surface fire would suffer continued departure from historical fire regimes. Nonnative invasive species would continue to displace native vegetation as well as rare and sensitive species, as soil surfaces are disturbed by high-severity wildfire. Species diversity would continue to decline as shade-tolerant species become dominant and alter species composition (Fulé and Laughlin 2007), particularly in the understory, with projected decline of the grass, forb, shrub matrix (Reynolds and others 2013) as resources (light, water, nutrients) may become limiting. In the long term (decades), stand structure would become more homogenous with reduced structural and spatial heterogeneity as even-aged trees are dominant on the landscape scale; impacts of the no action would be continued decline of forest health, reduced resiliency to disturbance, and impaired ecosystem processes in frequent fire vegetation communities.

- Stand density would remain overgrown or increase and hazardous fuel loadings would be retained and continue to accumulate. If a wildfire ignition occurs under these conditions, there is potential that it would consume large areas of standing native vegetation, remove seed banks, damage soils and hydrological processes, and create large areas of exposed soil, making the areas vulnerable to increased invasive plant establishment. Over time (decades) there would be a shift to early successional species and a change in the structure and function of the community.

- Old-growth stand components would be subject to continued declines resulting from stand-replacing high-severity wildfire, and mortality of large mature trees from water stress, insects, and disease. Old-growth stand components are the most vulnerable conifer stand components to the increasing adverse effects of higher temperatures and drought from climate change.

- Encroaching shrubs and trees, and invasion by nonnative species would continue, this would result in short-term (one to two growing seasons) and long-term (greater than 2 years) adverse impacts as the abundance and quality of montane grasslands decline. There would be no beneficial impacts derived from the lack of restoration treatments to maintain and restore grassland communities.

Use of Fire

The following impacts would result from an absence of prescribed burning, pile burning, and jackpot burning:

- A lack of broadcast burning could preclude any beneficial impacts to woodland and forest vegetation that may result from the addition of ash, organic matter, and nutrients to the soil. Native herbaceous understory vegetation would be more productive and tree sapling densities lower with frequent low-severity surface fires. Fire-adapted ecosystems would not be maintained and/or restored and could cause a decline in vegetation health, vigor and resiliency, species composition, and overall plant diversity. Fuel loading, particularly in the understory, would continue to increase, elevating the wildfire hazard of overstory woodland and forest species. The lack of action would result in short-term (one to two growing seasons) and long-term (decades) adverse impacts as fire-adapted woodlands and forests continue to degrade.

- A lack of pile burning and jackpot burning would preclude any beneficial impacts to vegetation communities resulting from thinning and piling of target vegetation. Increases in stand density and proliferation of ladder fuels would continue. Encroachment of woodland species into shrub and grasslands would continue. The lack of action would result in short-term (one to two growing seasons) and long-term (decades) adverse impacts as the density of stands continue to grow beyond the natural range of variability and woodland communities encroach onto open grassland areas.

Fire Suppression

The following impacts would result from suppression tactics in the absence of treatments.

- The absence of vegetation thinning treatments and prescribed fire to reduce hazardous fuel loads, would keep the current overgrown forests with unnaturally (pre-European settlement) high fuel loads that result in catastrophic high-severity wildfire. Unplanned ignitions could quickly transition to fast-moving wildfires which burn with greater intensity, take longer to extinguish, and burn more acres. Uncharacteristic stand-replacing fire would exhibit intense fire behavior, including active crown fire, with extreme spread rates and flame lengths; extreme fire behavior would limit the ability of firefighters to suppress the fire safely, resulting in large number of acres potentially undergoing stand replacement, which results in high levels of tree mortality and potential for long-lasting adverse impacts to natural and cultural resources. This could result in short-term (one to two growing seasons) and long-term (decades) adverse impacts to vegetation communities, particularly non-fire-adapted vegetation communities. Adverse impacts of wildfire include increased use of indirect suppression tactics, such as aerial retardant use and backfiring of large units from superior holding features resulting in larger areas burned, the removal of vegetation along containment lines resulting in the direct loss of individual plants; trampling of vegetation communities during suppression activities from firefighters, and equipment and vehicles causing crushing or removal of vegetation in localized areas. Suppression actions could also contribute to the spread of invasive nonnative species through transport on firefighting apparatuses.

- The threat of wildfire to communities at risk, community values at risk, and critical infrastructure would not be mitigated under the no action alternative. As highlighted in the Otero County Community Wildfire Protection Plan, much of the landscape is severely departed from its natural range of variability and hazardous fuel treatments are a priority for reducing wildfire risk and hazard. In the absence of treatments, fire behavior is projected to be severe, with risk of uncharacteristic stand replacement crown fire in many ecological response units. Under these conditions the potential for loss of life and property would be heightened. Some critical infrastructure located in the wildland-urban interface, for example fire stations, schools, and communication towers, could be lost if a fire escapes containment. A loss of infrastructure would heighten the risk to firefighters and the public as emergency responders, evacuation resources, and emergency shelters may be impacted. Community values at risk, including vulnerable watersheds, wildlife habitat, and scenic vistas, may be impacted. In the event of a severe wildfire, many natural resources would be adversely impacted and may take many years to decades to recover. Under a warming climate some natural resources that are valued by the public may never fully recover due to changing ecosystem functioning. Humanmade structures like federal buildings, commercial property, campgrounds, and hiking trails may be adversely impacted or lost in a wildfire and would need to be repaired or replaced, creating short- and long-term adverse impacts to users. In some instances, losses may be irreparable because of intrinsic historic or cultural values that cannot be replaced.

Alternative B – Proposed Action

Vegetation Thinning Impacts

The following impacts would result from the use of mechanical and manual treatment methods for vegetation thinning:

- Mechanical treatments that promote the growth of desirable species through modifying plant species composition, would increase plant species diversity in both the overstory and understory, increase structural diversity, and improve resilience of vegetation to insect, disease, and wildfire, thereby improving ecological function and resiliency of the existing woodland and forest ecosystem. Achieving any of these conditions would result in short-term (one to two growing seasons) and long-term (decades) beneficial impacts as the Lincoln National Forest goals and desired conditions are met. This would result in short-term (one to two growing seasons) and long-term (decades) beneficial impacts to woodland and forest stands. Ecological response units would trend back toward pre-European plant species compositions and physical structure. The more open stands would support frequent low-severity surface fires that would maintain the more natural stand structures and species compositions. Resource protection measures would greatly reduce the potential adverse impacts of heavy equipment damage to growing conditions and substrates.

- Old-growth stand components would be less prone to continued declines resulting from stand-replacing high-severity wildfire, and mortality of large mature trees from water stress, insects, and disease. Old-growth stand components are the most vulnerable conifer stand components to the increasing adverse effects of higher temperatures and drought from climate change. Tree thinning treatments aimed to improve the physiological health of large mature trees, including actions to protect against habitat loss in and surrounding Mexican spotted owl occupied and critical habitat, would be beneficial to old-growth stand components.

- Nonnative plant species, would remain static or decline across landscapes as native understory vegetation communities recover, and landscape scale disturbances to surface soils from high and moderate-severity wildfires decline. As native vegetation communities are restored, perennial native plants would be better able to out-compete nonnative plants. Resource protection measures would prevent or greatly reduce the potential introductions and spread of nonnative plant species.

- Hazardous fuel treatments applied in the protection of Mexican spotted owl occupied and critical habitat, critical infrastructure, community values at risk, and structures in the wildland-urban interface, would help to reduce susceptibility of vegetation to catastrophic wildfire and the loss of large areas of native woodlands and forests.

- Restoration treatments like thin and pile of pinyon-juniper woodland and mechanical manipulation of overstocked conifer forest stands, would remove individual trees but would provide improved resiliency of woodlands and forests to tree competition for sunlight, water and nutrient resources, and to wildfire as a whole. Treatments such as thin from below increase the crown base height which directly impacts the ease with which fire moves from the ground to the canopy. Thinning treatments also decrease the number of stems per acre, opening up the canopy, creating openings found to be suitable for Mexican spotted owl habitat, and allowing heat created by burning surface fuels to be dispersed more readily. All of these actions reduce the ease with which a fire can "torch" trees and/or transition to a crown fire and produce firebrands that create/ignite spot fires. Mitigations to wildfire behavior, as a result of the proposed action, would reduce the immediate and direct consequences of a fire to vegetation, soils, and hydrology (i.e., vegetation consumption, soil heating and erosion, and increased runoff), and reduce the time needed for native vegetation and ecosystem processes to recover. In the event that there is a wildfire, the moderated fuel loading resulting from planned fuel treatments would make suppression of a wildfire more easily attainable with fewer damaging suppression tactics required.

- Mechanized equipment used in the extraction of large trees for merchantable timber (for example, whole tree felling, manual harvesting using skidders, cut to length, skyline yarding, machine piling, plucking and mastication), could impact residual trees as a result of disturbance to substrates, potential damage to trees as a result of impacts during tree removal, and potential for increased erosion and soil damage from tracked vehicles which could impact root growth and stability. Appropriate thinning methods would be chosen based on site conditions and characteristics and the thinning prescription. Resource protection measures (see Chapter 2, Section 2.2.5) would be used with all mechanized treatments, which would limit the severity of the impact to growing conditions and residual stands. Impacts would be short term, lasting less than one to two growing seasons.

- Understory vegetation would be adversely impacted as a result of direct removal of ground cover during treatments and as a result of disturbance from machinery and road construction. Impacts would occur in the immediate vicinity of treatments and along access routes. Impacts would last one to two growing seasons. In the long term (greater than 2 years), increased light infiltration associated with increased canopy gaps would create beneficial growing conditions for most shade-intolerant species, resulting in increased ground cover and diversity in species composition.

- Impacts from thinning on steep slopes, including slopes over 40 percent, would be minimized by using low-impact equipment designs and by adherence to resource protection measures to reduce impacts to soils. Following treatments, reduced tree densities on steep slopes would reduce the potential for severe wildfire spread and intensity associated with steep terrain, which would otherwise result in extreme mortality and impacts to long-term recovery of the ecological response unit.

- Although mechanical treatments could result in the short-term loss of individual plants and adverse impacts to vegetation during the duration of the treatment and for one to two growing seasons following treatments, the long-term impacts to the plant population and community composition would be beneficial, due to beneficial impacts on nutrient cycling, plant productivity, reduced invasive species cover, and improved resilience to unplanned ignitions.

Use of Fire

The following impacts would result from the use of fire in the project area, including broadcast burning, pile burning, and jackpot burning.

- The use of broadcast burning would result in long-term (decades) benefits as a more open overstory and a perennial herbaceous understory would develop on most sites. Over time, more pronounced increases in species richness, diversity, and resiliency would occur with a tendency toward fire-tolerant plant species across the affected landscape. Over time and through repeated fire occurrence and adaptive management, fire regimes would be reduced to a lower condition class across the ecological response units, with less departure from historic conditions.

- Broadcast burning reduces the buildup of hazardous fuels, including fine fuels, duff, large woody fuels, shrubs, and other live surface and ladder fuels (Graham and others 2004). Broadcast burning can also substantially change forest structure after multiple burns and restore heterogeneity in forests that have become more homogeneous because of the absence of fire (Keifer and others 2000). Initial entry and maintenance prescribed fire may also result in an increase in mortality and reduce the amount of available logs and snags. However, with the anticipated mortality associated with prescribed burning, snags and logs would be created to offset the direct effect.

- Higher crown base heights and reduced densities result in increases to the crowning and torching indexes (meaning higher wind speeds are needed in order to move fire from the surface into the tree crowns), mitigating the potential for active crown fire (fire that transmits from the surface to the tree crown) and passive crown fire (fire that spreads through the tree crown independent of the surface) that would result in stand-replacing fires under certain fire weather conditions.

- Under reduced surface and ladder fuel conditions, if a wildfire ignition occurs there would be fewer fuels to support a high-intensity fire, therefore the immediate and direct consequences of a fire to vegetation, soils, and hydrology (i.e., vegetation consumption, soil heating and erosion, and increased runoff) would be mitigated, and native vegetation and ecosystem processes would take less time to recover. In the event that there is a wildfire, the moderated fire behavior resulting from thinning treatments would make suppression of a wildfire more easily attainable with a smaller number of personnel and with fewer damaging suppression tactics required. The potential size and scope of the fire on the landscape would be mitigated, reducing potential losses to homes, businesses, and infrastructure in the wildland-urban interface, as well as provide greater protections to natural and cultural resources.

- By emulating wildfire, broadcast burning would help the Lincoln National Forest move closer to the goal of promoting the role of fire in fire-adapted forest and woodland communities (communities composed of plant species that have evolved with special traits that promote a plants survival from fire and ability to thrive in a fire-prone environment at various stages in their life cycles).
- Broadcast burning, like other vegetation disturbance, can leave areas vulnerable to nonnative invasive species infestation (Sakai and others 2001; Zouhar and others 2008). The persistence of invasive populations and their potential for spread within burned areas depends upon fire type, severity, and frequency (Zouhar and others 2008). Although broadcast burning could increase the potential for invasion over the first one to two growing season post burn, the mitigating effects of broadcast burning on reducing the size and severity of future wildfires in turn reduces the potential for large-scale, intense infestations following a future large wildfire. Under certain prescriptions, broadcast burning could be used to control some nonnative invasive species, helping to prevent the displacement of native plant populations within the ecological response units.
- Broadcast burning could contribute to the spread of nonnative invasive species through transport on firefighting apparatuses and machinery. Resource protection measures to inspect all apparatuses prior to prescribed fire or mechanical treatment would be implemented to mitigate this threat. In the long term (over decades), the mitigation of large-scale, high-severity wildfire would result in lower threats of nonnative invasive species and reduced impacts to native vegetation communities.
- Broadcast burning could result in the loss of individuals and communities of plants for up to two growing seasons post fire (or longer for species that are not fire adapted). Site recovery would depend on each species' resistance or resilience when exposed to disturbance. Overall, in the long term, fire-adapted communities (such as ponderosa pine and Douglas-fir) would benefit from prescribed fire, since the understory would be thinned, litter converted to nutrients, and initial steps taken to reestablish a natural fire regime.
- The intensity of the prescribed fire is the main driver of its impact on the vegetation community and fuels. The intensity is controlled by careful timing, detailed planning, and the application of several resource protection measures. Mitigation measures such as rehabilitation of fire lines and other ground disturbance, and strict prescription windows employed in prescribed burn planning, mean that broadcast burning is designed to be lower in intensity than wildfire but can be used to optimize effects that promote fire-adapted species composition such as patchy structure and variable size classes. This promotes the survival of diverse species and seedbeds. Impacts on vegetation are therefore short and adverse during the broadcast burn, but beneficial following the first growing season post fire. Adaptive management would be employed so that areas can be treated on a rotation to move the community toward the desired conditions.

- Pile burning or jackpot burning of activity fuels from vegetation management and fuel treatment projects could result in temporary removal of vegetation species in the location of the pile and in direct vicinity of the pile due to trampling and disturbance during pile construction. If piles are large and burn under high severity some temporary soil impacts, for example surface and sub-surface heating, may delay reestablishment of grass and shrubs species in the location of the pile for one to two growing seasons. Invasive species may invade disturbed areas particularly where reestablishment of native species is delayed. Pile burning or jackpot burning could result in short-term adverse impacts; however, the impacts would be expected to last only the duration of the pile construction and burning and potentially for one to two growing seasons post-treatment.

- The removal of excess fuels to be piled would reduce stand density or halt woodland encroachment, promoting conditions for native shade-intolerant grass and shrub species to grow and be maintained, in the long term (decades), beneficial impacts to understory vegetation would be expected.

- Adverse impacts could occur if a prescribed fire, pile burn, or jackpot burn escaped containment. Desirable native vegetation may be adversely impacted if the species is not fire adapted or resilient to disturbance. In areas susceptible to wildfire effects, adverse impacts could be both short and long term if invasive species spread and outcompete the native plants in the burned areas. Resource protection measures would be employed to enhance containment of prescribed fire and reduce the potential for escape.

Management of Wildfire for Multiple Objectives

The following impacts could result from managing wildfires for multiple objectives under the proposed action.

- In fire-adapted vegetation communities located within the project area, beneficial impacts to vegetation could occur before a wildfire is extinguished. Suppressing wildfires to the least amount of acres burned means many areas would not realize the benefits that fire may have on improving conditions for the establishment and growth of native plants and reducing the density of invasive species. Under the proposed action, the Lincoln National Forest could implement the management of wildfire for multiple objectives. The types of impacts resulting from wildfire management for multiple objectives would be the same as described above for prescribed fire, for example vegetation removal, trampling, and crushing and potential of nonnative invasive species spread. The intensity of suppression activities is, however, expected to be lower than a suppression-only strategy, with fewer and more localized adverse impacts. For example, aggressive suppression may not need to be practiced in areas of fire-adapted vegetation where there is little risk of escape or adverse impact to structures or natural and cultural resources and therefore adverse impacts to vegetation would be lessened. The wildfire response of allowing wildfires to burn, depending on local conditions, would generate greater potential for long-term (decades) beneficial impacts to the ecological response units over a wider area.

- The threat of wildfire to communities at risk, community values at risk, and critical infrastructure would be mitigated under the proposed action. The high fire risk and hazard that is highlighted in the Otero County Community Wildfire Protection Plan, would be reduced through the application of hazardous fuel reduction treatments proposed for the project area. Following restoration treatments, fire behavior is projected to be mitigated, with reduced risk of uncharacteristic stand-replacement fire. In the event of an ignition, the potential for containment would be heightened as more direct suppression tactics could be used; the risk to life and property, critical infrastructure, and community values at risk would be reduced.

Herbicide Applications

Herbicide application would be applied for the control of resprouting species like Gambel oak (*Quercus gambelii*) and alligator juniper (*Juniperus deppeana*). These species occur throughout most ecological response units found in the project area. Some impacts of herbicide application common across all ecological response units where treatments would be applied are:

- Herbicide application should result in loss or damage to targeted plant species. Impacts to non-target species could occur as a result of herbicide drift. Any herbicide that remains in water in the soil is available for uptake by plant roots. If the water moves off-site or out of the rooting zone, it takes some of the dissolved herbicide with it. Depending on the distance of travel, the concentration of the herbicide, and type of herbicide used, this herbicide movement can be a problem to susceptible plants (U.S. Forest Service 1996a).

- Potential impacts to non-target species would be minimized by following herbicide application directions, limiting application to small areas, following label instructions, using only certified applicators, and applying hand application methods that use backpack sprayers or all-terrain vehicle/utility task vehicle–mounted tanks to isolate treatment within a small target area. Following these resource protection measures, adverse impacts from herbicide application would be adverse but contained to a small focal area.

- The use of herbicide treatment, would result in long-term (2 years to decades) beneficial impacts to native communities through reducing displacement by encroaching species, maintaining grassland openings, mitigating ladder fuels and overstocked stands and thereby maintaining ecological function and reducing crown fire potential.

Other Restoration Methods

Other restoration methods that may be implemented under this alternative could include site rehabilitation and planting, watershed improvement and erosion control, water developments, recreation sites improvement, and the development of interpretive sites. These methods are described below. Direct and indirect impacts common to all alternatives are described below.

Site Rehabilitation and Planting

Site rehabilitation may be required to mitigate effects caused by the project activities described above, including but not limited to the rehabilitation of skid trails and temporary roads constructed for treatment activities. Long-term site rehabilitation may also be required following any wildfires that may occur within the project area. Rehabilitation may include reseeding using native grasses and forbs or replanting native woody species. Site rehabilitation and planting activities could occur anywhere within the 140,000-acre project area, depending on need. It is most likely that tree planting would occur in mixed conifer or ponderosa pine forests. Site rehabilitation and planting would provide both short- and long-term beneficial impacts to vegetation communities by maintaining native species composition in the project area and mitigating against nonnative species invasion. Overall these methods would help the project area trend toward the desired conditions of maintaining and improving native vegetation community function and forest health and would not result in any short- or long-term adverse impacts.

Watershed Improvement and Erosion Control

Watershed improvement treatments would be designed to help the watersheds trend toward the desired conditions of maintaining and improving watershed functioning condition. Watersheds that are properly functioning have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients within the range of the natural variability for these processes (U.S. Forest Service 2011d). Restoration techniques would be designed to stabilize headcuts and other erosion issues in upland areas and along roadsides or similar areas; aeration of select meadows for plantings to increase diversity of forb and grass species; stabilization of ephemeral and intermittent channels to aid wildlife and livestock distribution; repair damage associated with dispersed and informal recreation; and improve road and trail conditions. These actions are expected to have both short- and long-term beneficial impacts to vegetation communities by improving resiliency to disturbance resulting from erosion, insect and disease or nonnative species infestations; protecting against adverse impacts from human use and recreation; promoting native plant community structure and composition, particularly in grassland areas and areas prone to disturbance from users; and, improving overall forest health by encouraging proper watershed functioning. Since resource protection measures would be applied with any watershed improvement project, no adverse impacts are expected to occur from implementation of these activities.

Special Use Authorizations

During public scoping and meeting with project stakeholders, the U.S. Forest Service was asked to identify areas within the project area that could be used to support forest industry activities, such as sorting yards, log processing sites, drum chippers, chip van loading locations, mobile incinerator sites, etc. Tasks carried out at processing sites include debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, scaling and weighing logs, and creating poles from suitably sized logs. Equipment types commonly used at processing sites include circular or band saws, various sizes and types of front-end loaders, log loaders, and chippers of several types, and may include timber processors, planers, associated conveyers, and log sorting bunks for accumulation and storage of logs. Electric motors and gas or diesel generators are also used to provide power. Mobile incinerators may also be used at these sites to dispose of wood waste.

Large processing sites are typically greater than 10 acres in size. Large sites allow for more flexibility in their design and allow for more areas to process, grade, scale and sort logs, manufacture materials, and chip and haul products. Medium-sized processing sites are 5 to 10 acres in size and log processing, equipment use, and storage is more limited. Landings at a timber sale area are considerably smaller than log sort yards and typically are about 0.33 acre.

It is expected there would be short-term adverse effects resulting from the activities within these areas due to increased soil exposure which makes sites vulnerable to infestation by nonnative species. Some residual standing trees may also be impacted by activities on the periphery of the site. Impacts would be expected to last for the extent of the activity and for 2 to 3 years following implementation. Longer-term adverse impacts are expected to be mitigated as sites become restored. Resource protection measures would be applied to alleviate adverse impacts to vegetation communities during implementation (see Chapter 2).

Road Management

Road management is an important aspect of the proposed action as the current road conditions within the project area are considered in poor condition according to the watershed condition framework. Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 125 miles of existing and new National Forest System roads would be used to complete the proposed activities and could include temporary road creation, rehabilitation of unauthorized routes, and road maintenance activities, including constructing and/or improving drainage features. Temporary roads would be obliterated and rehabilitated after vegetation thinning, prescribed fire, and watershed restoration treatments are completed.

Road management activities would have long-term adverse impacts that are common to all vegetation communities. Road construction would result in the removal and disturbance of vegetation along the road corridor and in adjacent staging areas. Vegetation growing conditions adjacent to roads would be altered as a result of soil compaction and erosion and altered hydrological functioning, including drainage and runoff. Some beneficial impacts would be felt for vegetation communities adjacent to existing roads that would be better maintained and undergo improvements to drainage features.

Increased road networks throughout the project area would increase potential nonnative invasive species infestation with road maintenance machinery and recreational vehicles serving as vectors for nonnative species spread. Resource protection measures would be applied for all maintenance and road construction machinery used to implement the proposed action; however, mitigation of infestations from recreational users would be difficult to enforce and would require long-term monitoring and treatment.

Adverse impacts would last the duration of the project, as access roads are constructed and used, but these impacts are not expected to persist once the area is rehabilitated following treatment implementation. The recovery of herbaceous vegetation communities is expected to take one to two growing seasons, whereas woodland and forest species would take many years to reestablish disturbed sites through natural succession.

In addition to facilitating access for implementing restoration treatments, road construction also provides beneficial impacts to fire and fuel resources as a result of providing access for fire suppression crews and by breaking up fuel continuity across the landscape. Depending on road widths and position, roads could act as fuel breaks from which suppression crews can fight fire and can slow surface fire spread, as fire hits non-vegetated road surfaces. Conversely, increased roads facilitate greater access by the public and increase the potential for ignitions from vehicles and others human use, increasing the potential for increased wildfire.

Impacts by Individual Ecological Response Units

The following sections are organized by ecological response unit. The affected environment for the specific ecological response unit is described first, followed by the environmental consequences of implementing the no action and the proposed action. Impacts that are common to all ecological response units are described above.

Mixed Conifer with Aspen Forest

Affected Environment/Existing Conditions

The Mixed Conifer with Aspen forest vegetation community generally occurs at elevations ranging from approximately 6,500 to 10,000 feet and on cooler and wetter sites. Tree species composition varies depending on seral stage, elevation, and moisture availability. It can be composed of early- and mid-seral species such as aspen, Douglas-fir, New Mexico locust (*Robinia neomexicana*), and southwestern white pine (*Pinus strobiformis*), and late-seral species such as maple (*Acer*), white fir, and blue spruce (*Picea pungens*). Ponderosa pine may be present in minor proportions. Currently late-seral stages dominate the landscape, while historically early-, mid- and late-seral stages were represented across the landscape. Douglas-fir may share dominance in younger stands and is a frequent canopy component in older stands, but white fir regeneration is always abundant. Understories are often shrubby, dominated by maple species on drier sites and oceanspray (*Holodiscus* spp.) on wetter sites, often mixed with Gambel oak. Grasses are uncommon (Kaufmann and others 1998). The project area is composed of closed forests with even-aged and uneven-aged stands across the landscape. Disturbances typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly fire), and small-scale frequent disturbances (fire, insect, disease, wind). Dick-Peddie (1993) provides detailed descriptions of the plant species compositions, the seral stages of ecological succession, and the processes causing succession for the Mixed Conifer with Aspen ecological response unit under the classifications: Subalpine and Upper Montane Coniferous Forests, and within class dominant species associations or series that occur in cooler and moister environments, especially the Blue Spruce, White Fir-Douglas-fir and Douglas-fir-Southwestern White Pine Series. Succession in Mixed Conifer with Aspen forests was historically initiated by catastrophic wildfire and logging, and quaking aspen (*Populus tremuloides*) is a dominant early seral species.

Mixed Conifer with Aspen ecological response unit vulnerability to climate-induced environmental stress across the Lincoln National Forest (percent of total unit landscape) over the next 20 years is: Low Vulnerability 0 percent; Moderate Vulnerability 4 percent, High Vulnerability 65 percent, and Very High Vulnerability 31 percent (see Figure 3-4) (U.S. Forest Service 2017c).

Historically, these forests burned through surface, crown, and mixed-severity fire regimes (Dick-Peddie 1993; Margolis and Malevich 2016; Margolis and others 2007; Swetnam and Baisan 1996), with the forest type experiencing fire every 35 to 200 years (Evans and others 2011). A surface fire regime is characterized by frequent, low-intensity, low-severity fires with short flame heights. In contrast, a crown fire regime has infrequent, high-intensity, high-severity fires that burn the crowns of trees, also known as stand-replacing fires. A mixed-severity fire regime exhibits both surface and crown fires, with more widespread dominance of surface fires than crown fires (Swetnam and Baisan 1996). A study by Brown and others (2001) of fire history in the Sacramento Mountains found a Weibull Mean Probability Interval of 10.2 years, 8.7 years, and 10.8 years for the three highest-elevation mixed-conifer sites with a 5 to 95 percent fire interval 1 to 30 years.

Historically Mixed Conifer with Aspen forests were generally much more open than those of the present (Dick-Peddie 1993; Kaufmann and others 1998). Historic basal areas were 35 to 45 percent of today's basal areas and trees per acre were 15 to 25 percent of today's numbers. Crown biomass has increased 120 percent at low elevations and as much as 270 percent at higher elevations (Kaufmann and others 1998). As a result of lower tree densities, herbaceous understories were historically more abundant (Jones 1974). Overall, stands were composed of larger, older trees that are more widely spaced, and generally without the dense thickets of evergreen saplings that are present today (Kaufmann and others 1998). Patches of old trees were interspersed with patches of young trees, aspen, and openings, where surface fires had transitioned to crown fires and burned more intensely in a particular area (Kaufmann and others 1998). Most stand-replacing fires occurred at moister locations, at higher elevations and on steep north-facing slopes, where fire was less frequent, fuels were able to accumulate, and stand density supported high-severity fire (Evans and others 2011; Holden and others 2009). Under drought conditions, stand-replacing fires were more common (Jones 1974). Aspen was the key vegetative component following stand-replacing fire and was more common in historic periods due to the frequency of disturbance (Jones 1974).

A number of bark beetle species are impacting Mixed Conifer with Aspen conifer species in the area, particularly those trees already stressed as a result of competition and drought (Savage and others 2013). Western spruce budworm is a defoliating insect that primarily impacts understory white fir and Douglas-fir in the Southwest, and western tent caterpillar affects aspen. Dwarf mistletoes, found on most conifers in the ecological response unit, further exacerbate the likelihood of insect outbreaks (Margolis and others 2007).

Extensive logging and altered fire regimes over the past century have drastically reduced the spatial extent of old growth, resulting in multi-layered forest stands with younger trees and higher-than-normal densities of fire-intolerant species (Dahms and Geils 1997; Kaufmann and others 1998). Currently only 212 acres (0.8 percent) are in the Mature and Old Forest stages.

The majority of the ecological response unit is now classified as medium seral state (Table 3-3 and Figure 3-5.). The existing conditions of the stands therefore have a predominance of young to mid-aged forest stages, with high numbers of trees per acre, high basal areas, and over 50 percent canopy cover. Crowning index is low, meaning that crown fire could be initiated at low wind speeds, under 17 miles per hour.

Table 3-3. Mixed Conifer with Aspen Forest Indicators, Existing Condition

Mixed Conifer with Aspen Seral Stage	Acres	Vegetative Structural Stage	Trees per Acre	Basal Area	Canopy Cover (percent)	Crown Base Height (feet)	Fuel Loading (tons/acre)	Crowning Index (miles/hour)	Torching Index (miles/hour)	Fire Regime Condition Class
Aspen	4,590	3	723	148	68	8.2	62	26	0	1
Very Large Closed	178	5/6	278	163	46	4.3	65	22	0	2
Very Large Open	34	5/6	88	85	20	9.9	92	19	0	2
Medium	17,025	3/4	393	168	53	4.6	62	17	0	2/3
Seedling/ Small	4,185	2	335	49	27	1.9	45	26	0	2
Grass/Brush	58	1	36	5	4	2.5	30	11	0	1
Total	**26,070**									

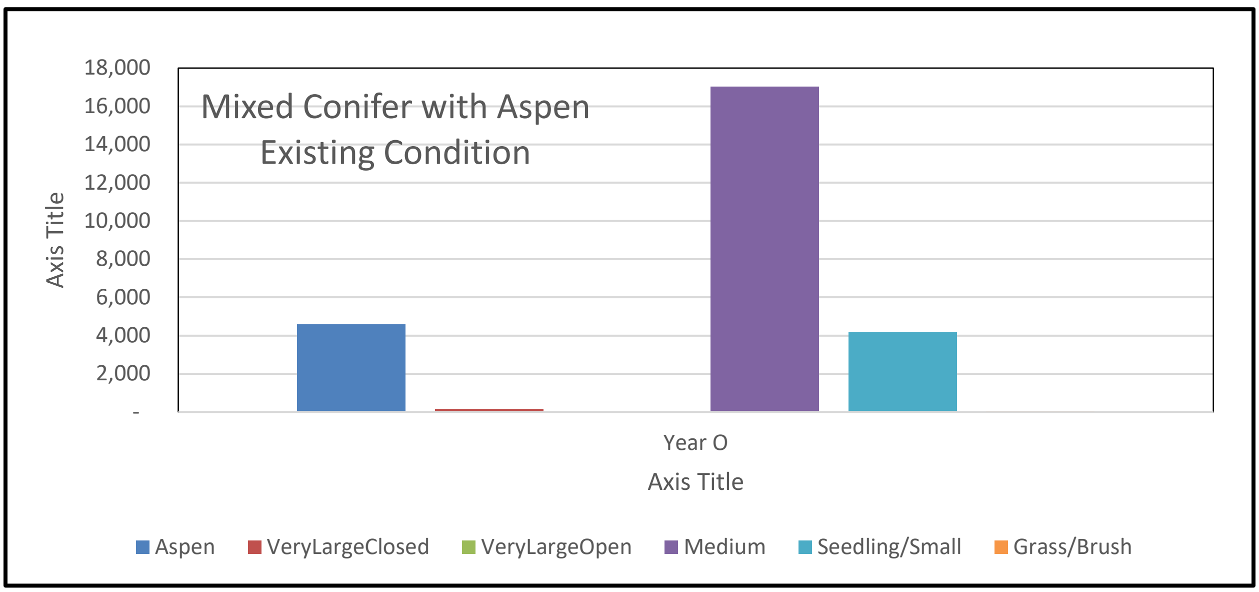

Figure 3-5. Composition of seral states for existing Mixed Conifer with Aspen within the South Sacramento Restoration Project Area.

The Fire Regime Condition Class data suggest that 83 percent of the Mixed Conifer with Aspen ecological response unit falls within a Fire Regime Condition Class of 2 or 3, with only 17 percent classified as Fire Regime Condition Class 1; the majority of the ecological response unit has therefore substantially departed from the historical regime. Areas in Class 3, which include the medium seral stage, have the potential to contribute to large fire size and high fire intensity and severity across the landscape.

Environmental Consequences

The effects of implementing the no action alternative and the proposed action are presented below in Figure 3-6 and Table 3-4.

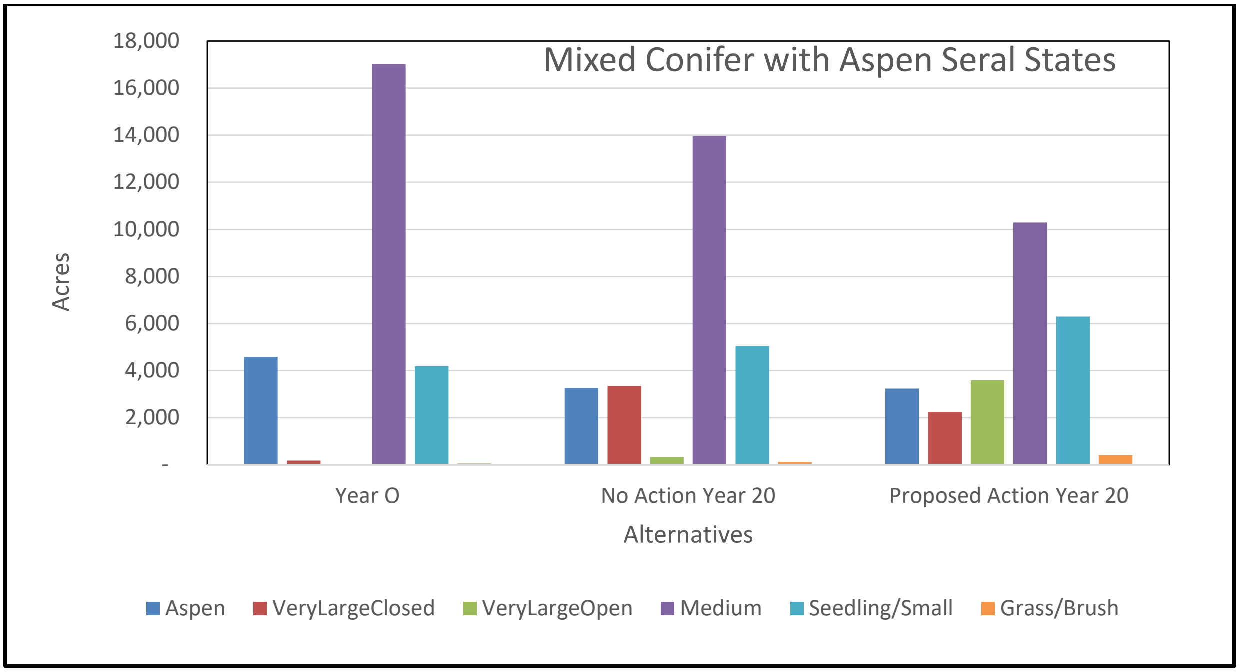

Figure 3-6.. Impacts common to all alternatives are described above. Specific impacts to the Mixed Conifer with Aspen ecological response unit are described below.

The no action alternative and proposed action are presented in the same table and graphs for comparison. Table 3-4 provides a row for each seral state that makes up the Mixed Conifer with Aspen ecological response unit. As the reader moves down the rows, the associated stand structure for each seral state (i.e., vegetation structural state, trees per acre, basal area, etc.) changes. The first column in the table shows the acreages within each seral state at year 0 (the existing condition). Column two shows how after 20 years under the no action alternative, the acres within each seral state would be distributed. Column three shows how after 20 years under the proposed action, the acreages in each seral state shift, with fewer acres within the medium state and those acres instead distributed between the very large closed, very large open, and seedling small states. Generally, this means that the proposed action would result in more open stands with less interlocking canopies, with fewer small-diameter trees and a greater proportion of larger-diameter older trees.

The remaining columns in Table 3-4 describe the stand structure characteristics for each state, which do not vary by alternative. The graph (see Figure 3-6.) shows the redistribution of acres of Mixed Conifer with Aspen stands between each state under the no action and proposed action, relative to the existing condition.

Table 3-4. Indicators for the Mixed Conifer with Aspen Ecological Response Unit under the No Action and Proposed Action, Relative to the Existing Condition

Mixed Conifer with Aspen Seral Stage	Acres Year 0	Acres No Action Year 20	Acres Proposed Action Year 20	Vegetative Structural Stage	Trees per Acre	Basal Area	Canopy Cover (%)	Crown Base Height (feet)	Fuel Loading (tons/acre)	Crowning Index (miles/hour)	Torching Index (miles/hour)	Fire Regime Condition Class
Aspen	4,590	3,259	3,239	3	723	148	68	8.2	62	26	0	1
Very Large Closed	178	3,351	2,240	5/6	278	163	46	4.3	65	22	0	2
Very Large Open	34	334	3,587	5/6	88	85	20	9.9	92	19	0	2
Medium	17,025	13,959	10,296	3/4	393	168	53	4.6	62	17	0	2/3
Seedling/Small	4,185	5,048	6,293	2	335	49	27	1.9	45	26	0	2
Grass/Brush	58	120	416	1	36	5	4	2.5	30	11	0	1
Total	**26,070**	**26,070**	**26,070**									

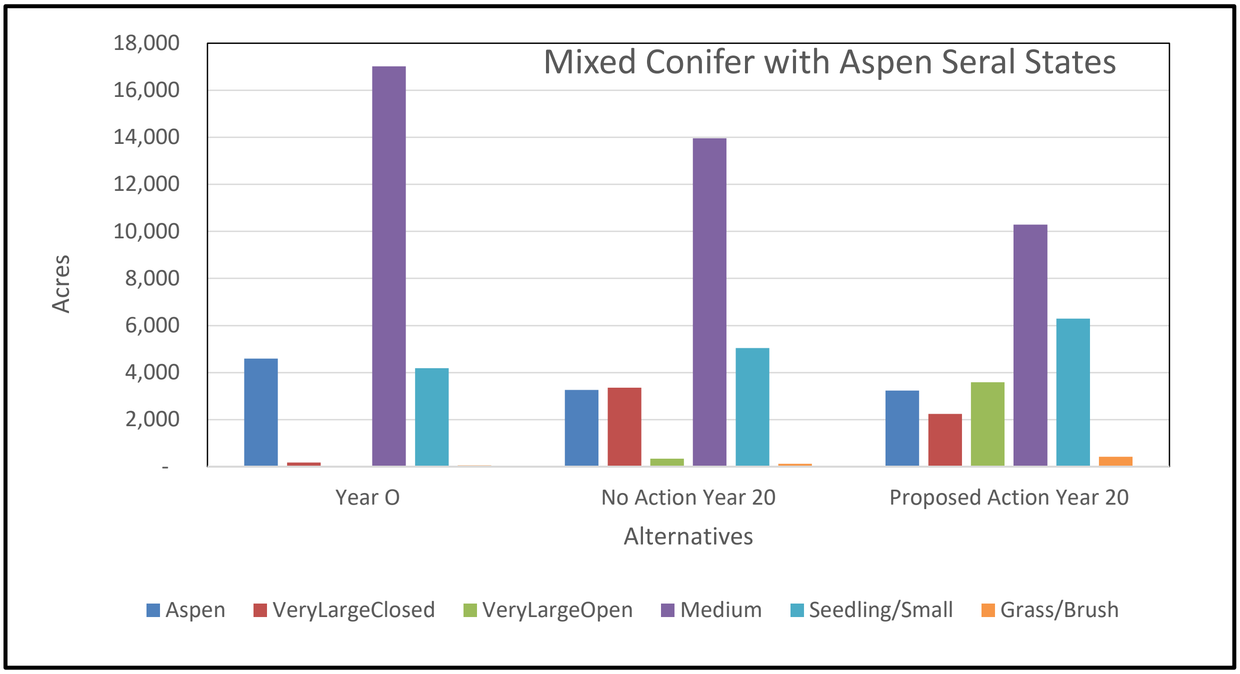

Figure 3-6. Composition of seral states for Mixed Conifer with Aspen within the South Sacramento Restoration Project area under the no action and proposed action, relative to the existing condition (Year 0).

Alternative A – No Action

Under the no action alternative, the proposed forest restoration activities would not occur within the project area. Therefore, no long-term beneficial impacts to Mixed Conifer with Aspen vegetation communities, fire, and fuels would occur.

After 20 years, there would be a reduction in the acreage of medium states (medium-sized tree states with both closed and open canopies), with increased acres of very large closed state (with large trees and greater than 30 percent canopy cover), and increased seedling small state areas (with seedling and sapling-sized trees). The ecological response unit would exhibit a continuing high competition for resources, poor individual tree vigor and growth, and a continuation of poor overall forest health conditions and a decreasing resilience to insects and disease. The high risk of insect and disease would not be lowered relative to existing insect and disease risk Figure 3-7.

In the absence of restoration treatments, the Mixed Conifer with Aspen ecological response unit is predicted to remain within an unhealthy condition relative to desired conditions as the homogeneous stand structure is perpetuated, with a predominance of young and medium-aged trees in dense stands, with high numbers of trees per acre and few old-growth trees. In the long term (decades), stand structure would become more homogeneous with more even-aged trees, creating an adverse impact on forest and woodland health and impacting forest resiliency to insect and disease. The Western spruce budworm is a major defoliating insect of white fir, Douglas-fir, and blue spruce trees in the project area. Those species of conifer trees are more susceptible to outbreaks and to mortality from Western spruce budworm when stands are overgrown and individual trees are less able to chemically defend themselves from the budworms (Dick-Peddie 1993).

Stands of aspen (which is an early seral species within the Mixed Conifer with Aspen ecological response unit) are expected to decline in the absence of treatments due to persistence of the conifer component as conifer saplings and trees displace aspen cohorts and shade out aspen regeneration. Aspen are especially susceptible to insect and disease which usually attack mature trees. Western tent caterpillar and large aspen tortrix (*Choristoneura conflictana*), combined with Marssonina leaf blight (*Marssonina populi*), are expected to continue to defoliate aspen, as has been observed in existing stands (Kaufmann and others 1998); continued prevalence of various trunk rots and stem cankers would also cause significant reductions of growth and vigor in mature stands.

Due to crown continuity, aspect, slope, and topographic locations of much of the Mixed Conifer with Aspen forest in the project area, these stands are vulnerable to crown fire. Under the no action, characteristic stand-replacement fire modeled under the existing condition is projected to increase slightly, while nonlethal and mixed-severity wildfire is projected to decrease slightly Figure 3-7). Although mixed to high-severity wildfire is characteristic of the Mixed Conifer with Aspen community, large stand-replacement fires are rare, and severe wildfire has the potential to not only consume large areas of standing native vegetation, but also remove seed banks, damage soils, interfere with natural hydrological processes, and create large areas of exposed soil, making the areas vulnerable to increased nonnative invasive plant species establishment and post-fire erosion, which impacts regeneration of Mixed Conifer with Aspen vegetation communities. Mixed-conifer stands are also highly susceptible to wind throw when the stands are opened (Kaufmann and others 1998); therefore, residual trees following stand-replacement fires are vulnerable to damage over the long term (decades). Stand-replacement fires predicted under the no action are characterized by high flame lengths, rapid rates of spread and high fire line intensity (the heat per unit area of the flaming front). This extreme fire behavior would be difficult to suppress through direct suppression tactics, limiting the capacity of fire crews to safely contain the fire without significant resources and expense.

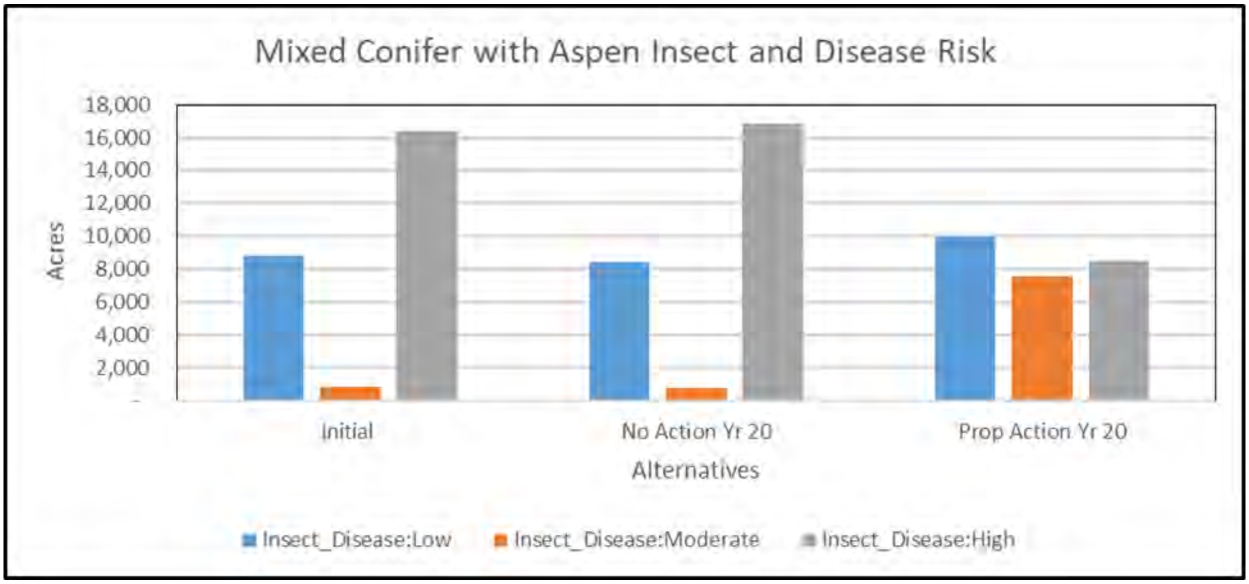

Figure 3-7. Modeled insect and disease risk under each alternative.

In the event of a stand-replacing fire, there would be a shift to early successional species, including increased dominance by aspen and a change in the structure and function of the community; impacts would be severe, adverse, and long lasting (decades). High-severity stand-replacing wildfire is becoming more common with climate change, and historic climax Mixed Conifer with Aspen stands may not persist as they are eliminated by drought and catastrophic wildfire. The current Mixed Conifer with Aspen stands may be replaced by plant species that are better adapted to drier and warmer conditions. Aspen or other woody vegetation, including lower-elevation conifer species, may replace the high-elevation fir species. Overgrown old-growth Mixed Conifer with Aspen stands are especially vulnerable to physiological water stress caused by warming and drying climate when growing in high densities.

A breakdown of the four seral states containing mature and old forest stages is shown in Figure 3-8 and Table 3-5. These states are expanded from the Very Large Closed and Open States used in the broader analysis to show more detail on the impacts to Old Growth Forests.

Under the no action alternative, states containing Old Growth increase to 3,684 acres (14.3 percent) over the next 20 years, primarily transitioning from medium-size tree states stemming from tree growth (see Table 3-5 and Figure 3-9). Most of this increase (77 percent) is in the closed multi-storied state, the least resistant state to fire, insect, and disease threats.

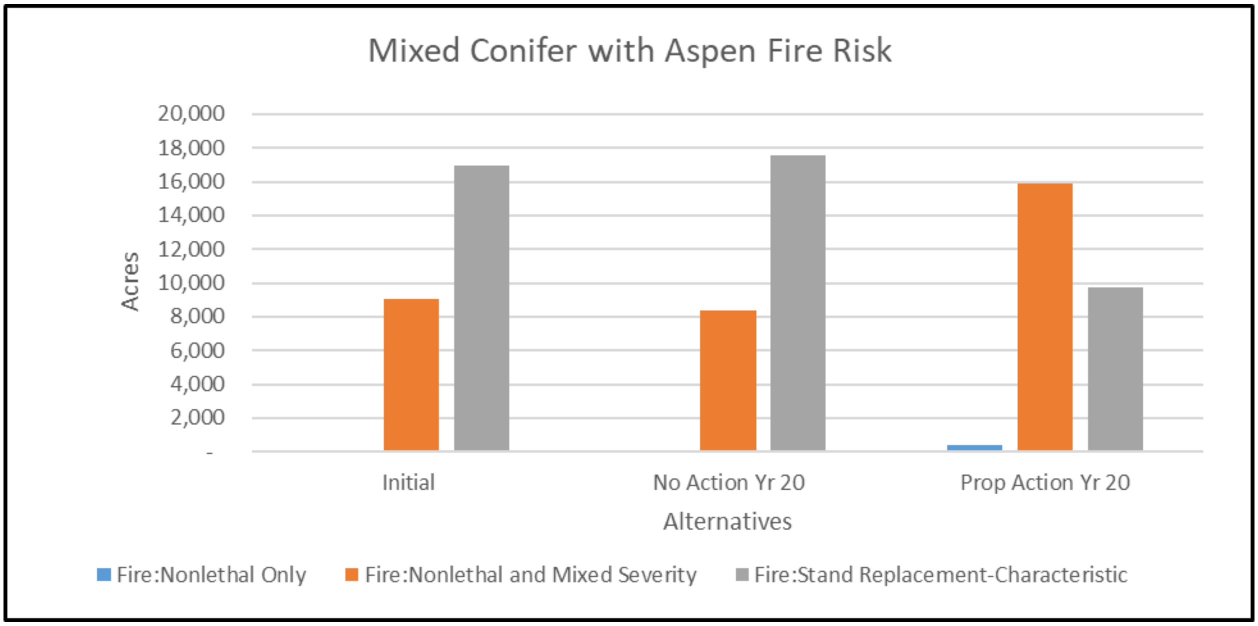

Figure 3-8. Modeled fire risk to Mixed Conifer with Aspen ecological response unit under each alternative, compared with the existing conditions.

Table 3-5. Mixed Conifer with Aspen Large Tree States (Vegetative Structural Stages 5 and 6), Current, No Action, and Proposed Action

Mixed-Conifer with Aspen	Current Condition	No Action at 20 Years	Proposed Action at 20 Years
Closed Multi-Story	24	2,850	1,885
Closed Single Story	154	500	354
Open Multi-Story	2	178	2,270
Open Single Story	32	156	1,317
Total	**212**	**3,684**	**5,826**

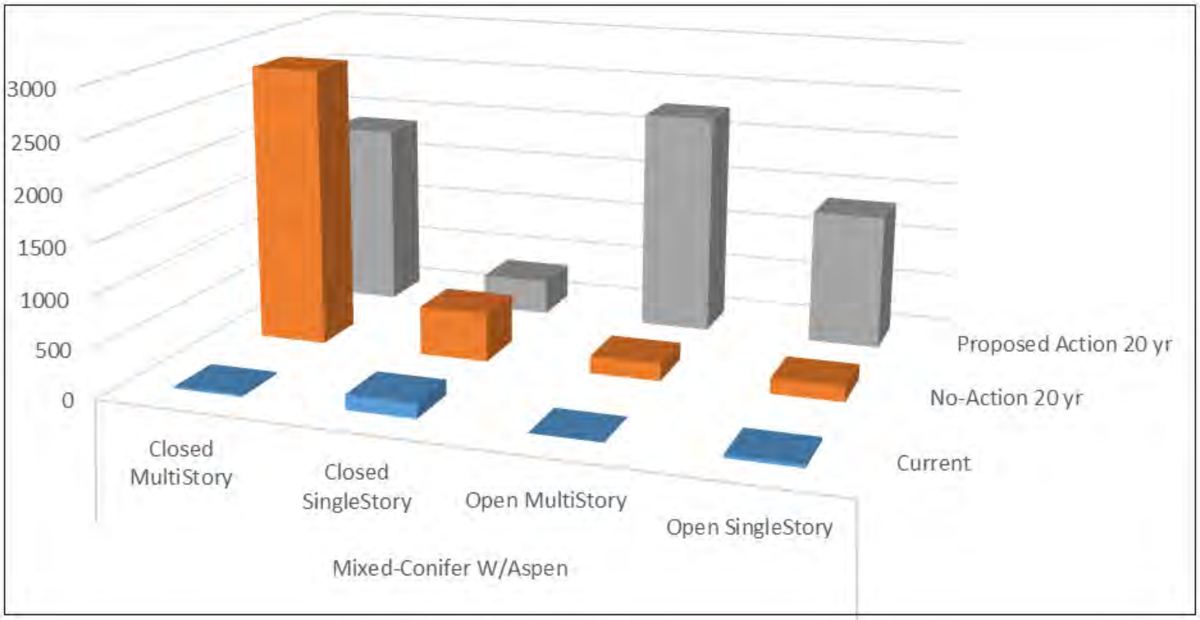

Figure 3-9. Mixed Conifer with Aspen large tree states (Vegetative Structural Stages 5 and 6), current, no action, and proposed action.

Alternative B – Proposed Action

Vegetation Thinning

Vegetation thinning would impact 12,927 acres of Mixed Conifer with Aspen in the project area. Over one-half of the ecological response unit (7,431 acres) would be treated with Group Selection with Matrix Thinning, which would manage the large closed, large open, and medium seral stage trees in order to create small groups of trees and thin between groups, increasing stand heterogeneity, moving stands toward uneven-aged desired conditions. Free thinning treatments on 4,351 acres would alter species composition and improve stand health and vigor by favoring shade-intolerant species, reducing competition and removing disease-infested trees within the large closed, and medium seral stages and within the Aspen seral stage. Thin from below treatments on 1,145 acres would help to reduce densities of suppressed understory species within the seedling and small sapling stage (see Table 3-4). As shown in Table 3-4 and Figure 3-6, the number of acres within the medium seral state declines under the proposed action; the medium seral state is characterized by high numbers of trees per acre and high basal area. By moving stands from the medium seral state, into the large open canopy state, and from a Vegetative Structural Stage class of 3/4 to a Vegetative Structural Stage class of 5/6, average trees sizes are increased, trees per acre are reduced, densities and basal areas are reduced, and canopy cover is decreased. By opening up the stands, breaking up the continuity of vegetation and fuels and increasing heterogeneity of tree age and size classes within the ecological response unit, mechanical treatments would improve the overall health and resiliency of residual stands to insect, disease and other disturbances in the long term (greater than 2 years). Treatments would thereby promote the long-term (greater than 2 years to decades) health and vigor of residual trees in larger size classes.

Thinning treatments would create a more patchy structure that would impact species composition and the prevalence of some species especially those dependent on seral stages. Understory and early seral species such as aspen, Rocky Mountain maple (Acer glabrum), oceanspray, snowberry (Symphoricarpos albus laevigatus), and many species of grasses and forbs, including fringed brome (Bromus ciliatus), muttongrass (Poa fendleriana), sedges (Carex spp.), groundsels (Senecio spp.), violets (Violaceae), strawberries (Fragaria), and fleabanes (Asteraceae) (Dick-Peddie 1993). The mosaic of different stand structures would support a greater diversity of plant species, including those of different seral stages. Such heterogeneity in native vegetation would make the entire Mixed Conifer with Aspen ecological response unit more resistant and more resilient to stand-replacing high- and moderate-severity wildfire, and less susceptible to mature tree mortality from increasing water stress, tree disease, and insect outbreaks. Overgrown stands of white fir are especially vulnerable to Western spruce budworm outbreaks, while low-density stands are less vulnerable. Nonnative invasive plant species colonization is often exacerbated by soil surface disturbance. Under the proposed action, thinning treatments would help to mitigate catastrophic wildfire, limiting large-scale soil disturbance and therefore minimizing potential colonization of nonnative invasive plants. By improving forest health, nonnative invasive plant species would be subject to interspecific competition by native perennial plants for plant water and nutrient resources, limiting their colonization success.

Selective treatments that target insect- and disease-infested species under the proposed action, and the improved vigor and resiliency associated with reduced stand densities under this alternative, are also modeled to improve resiliency to future insect and disease. Under the proposed action, acres modeled to be vulnerable to high levels of insect and disease are shown to be reduced by 30 percent, compared with the existing condition. Aspen populations that are particularly prone to insect and disease, would benefit from improved stand conditions and reduced potential for infestation. Douglas-fir and white fir are primary hosts for the spruce budworm; significant outbreaks have been recorded in the project area attributed to dense stand condition and periods of prolonged drought (Kaufmann and others 1998). Multiple crown layers and crown closure increase the chances that a larvae would land on suitable food sources (Lynch and Swetnam 1992); as shown in modeling results (seeFigure 3-6)vegetation thinning treatments under the proposed action that reduce stand density and improve tree vigor during periods of drought, may increase Mixed Conifer with Aspen species' resiliency to future insect and disease attack over the long term.

Mixed Conifer with Aspen is characterized as a mixed to high-severity fire regime with a fire return interval of 35 to 200 or more years (Fire Regimes III, IV, and V). High-severity fire regimes are rare and occur usually at higher elevations (Holden and others 2009). The treatments would move stands from a predominance of Fire Regime Condition Class 2/3 toward open stages classified as Fire Regime Condition Class of 2 or 1, reducing the acreage of Mixed Conifer with Aspen that is currently extremely departed from the natural range of variability. As stands are shifted from a medium state and large closed state to a large open state, crown base heights are raised as small-diameter trees are removed from the stands in order to favor larger trees and reduce densities and ladder fuels. Compared with the no action, greater crown base heights, and reduced densities under the proposed action result in increases to the crowning and torching indexes (see Table 3-4), meaning higher wind speeds are needed in order to move fire from the surface into the tree crowns.

Coarse woody debris, including downed logs, would vary as acreages within the ecological response unit are shifted to different seral stages. Vegetation treatments under the proposed action shift states from early- to mid-seral stages to later-seral stages, resulting in an increase in coarse woody debris as per the desired condition for the ecological response unit. Fuel loading increases as stands are shifted from medium to more large open canopy seral stages. Increased surface fuels contribute to the mixed-severity fire regime that is characteristic of the vegetation community.

Fire behavior under the proposed action is predicted to be reduced in severity as the residual stands exhibit more open structures, higher crowns, and increased heterogeneity in structure and size class. Under the proposed action, the risk of uncharacteristic stand-replacing fire is reduced by 29.6 percent, compared with the existing condition. The acreage of nonlethal mixed severity fire is modeled to increase, bringing the ecological response units into closer alignment with desired conditions. Under a moderated fire regime, potential high mortality resulting from an unplanned ignition would be reduced and therefore adverse impacts associated with high mortality are mitigated in the long term (greater than 2 years). Furthermore, mitigating fire behavior in Mixed Conifer with Aspen stands that are characterized as a mixed and high-severity fire regime, reduces the potential that these fires would spread to adjacent ecological response unit vegetation communities, such as Mixed Conifer-Frequent Fire and ponderosa pine forest that would historically have burned with lower severity.

Under the proposed action alternative, states containing Old Growth increase to 5,826 acres (22.4 percent) over the next 20 years, primarily transitioning from medium-size tree states stemming from tree growth and treatments (see Table 3-5 and Figure 3-9). This increase is spread evenly between the closed multi-storied state and the open multi-storied and open single-storied states; the latter two states are the more resistant states to fire, insect, and disease threats.

Use of Fire

Prescribed fire (broadcast burning and pile burning) would be used to treat 16,773 acres of the Mixed Conifer with Aspen ecological response unit, typically following vegetation thinning treatments. All forms of prescribed fire treatment may be applied.

Through monitoring and the use of adaptive management concepts, prescribed fire prescriptions would be established so that fire intensity is carefully managed in order to meet desired conditions characteristic of a mixed-severity fire regime. Appendix D of the Vegetation Communities and Fire and Fuels Report demonstrates that most acres of Mixed Conifer with Aspen would be treated with moderate-intensity wildfire (U.S. Forest Service 2018a). Low-intensity fire is not possible in these states due to heavy fuel loading and structure. Most treatments (13,661 acres) would target the medium seral stage, seedling, and small sapling, and the very large closed stages. Moderate-intensity treatments would result in higher mortality and creation of more open and patchy stand structures. Low-intensity prescribed fire would be applied to 3,112 acres of the medium-stage stands in order to reduce ladder fuels and open up the understory.

The continued application of prescribed fire would result in beneficial impacts to the vegetation communities within this ecological response unit as the ecosystem is improved and maintained. Prescribed fire would help modify plant species composition, promote growth of desirable tree species; control and eradicate invasive plants, increase the amount of fire-adapted vegetation, protect old-growth trees, reduce fuel loading, and create conditions that promote plant species diversity and abundance. Monitoring results would be used to improve prescriptions to enhance treatment success. Impacts would depend on the frequency of prescribed fires, the number of acres burned in a given cycle, and vegetation species being burned. Achieving any of these conditions would result in short-term (one to two growing seasons) and long-term (decades) beneficial impacts as the Lincoln National Forest goals and desired conditions are met. Impacts on vegetation from prescribed fire are short and adverse during the prescribed burn, but beneficial following the first growing season post-fire.

Adaptive management would be applied throughout the life of the project to ensure that treatments are moving Mixed Conifer with Aspen forests closer to desired conditions. Periodic monitoring would be applied throughout the project area, and monitoring results would be documented and reviewed to determine whether adjustments in design features should be made to maintain or improve resource conditions.

Montane Subalpine Grassland

Affected Environment/Existing Conditions

Montane Subalpine Grassland vegetation generally occurs between 8,000 and 10,000 feet and often harbors several plant associations with varying dominant grasses and herbaceous species. Such dominant species may include Thurber fescue (*Festuca thurberi*), Arizona fescue (*Festuca arizonica*), pine dropseed (*Blepharoneuron tricholepis*), Kentucky bluegrass (*Poa pratensis*), and various sedges. Trees may occur along the periphery of the meadows, which may include Engelmann spruce (*Picea engelmannii*), blue spruce, Douglas-fir, white fir, and southwestern white pine. Some shrubs may also be present. These meadows are seasonally wet, which is closely tied to snowmelt, though they typically do not experience flooding events. Dick-Peddie (1993) describes the plant species compositions and natural succession processes for the Montane Subalpine Grassland ecological response unit under Subalpine Montane Grassland, and provides detailed listings of plant species and ecological succession seral stages. Domestic livestock grazing is generally intense in these montane grasslands, and has caused changes in dominant grass species compositions, especially the replacement of Thurber fescue by Arizona fescue and Kentucky bluegrass (Dick-Peddie 1993).

Montane Subalpine Grassland ecological response unit vulnerability to climate-induced environmental stress across the Lincoln National Forest (percent of total unit landscape) over the next 20 years is: Low Vulnerability 18 percent; Moderate Vulnerability 31 percent, High Vulnerability 45 percent, and Very High Vulnerability 6 percent (see Figure 3-4) (U.S. Forest Service 2017c).

Environmental Consequences

Resource indicator measures for the Montane Subalpine Grassland ecological response unit are not included in this analysis since the measures pertain to forested and woodland vegetation only. Impacts common to all alternatives are described above. Specific impacts to the Montane Subalpine Grassland ecological response unit are described below.

Wildfire risk is modeled under all alternatives in Figure 3-10.

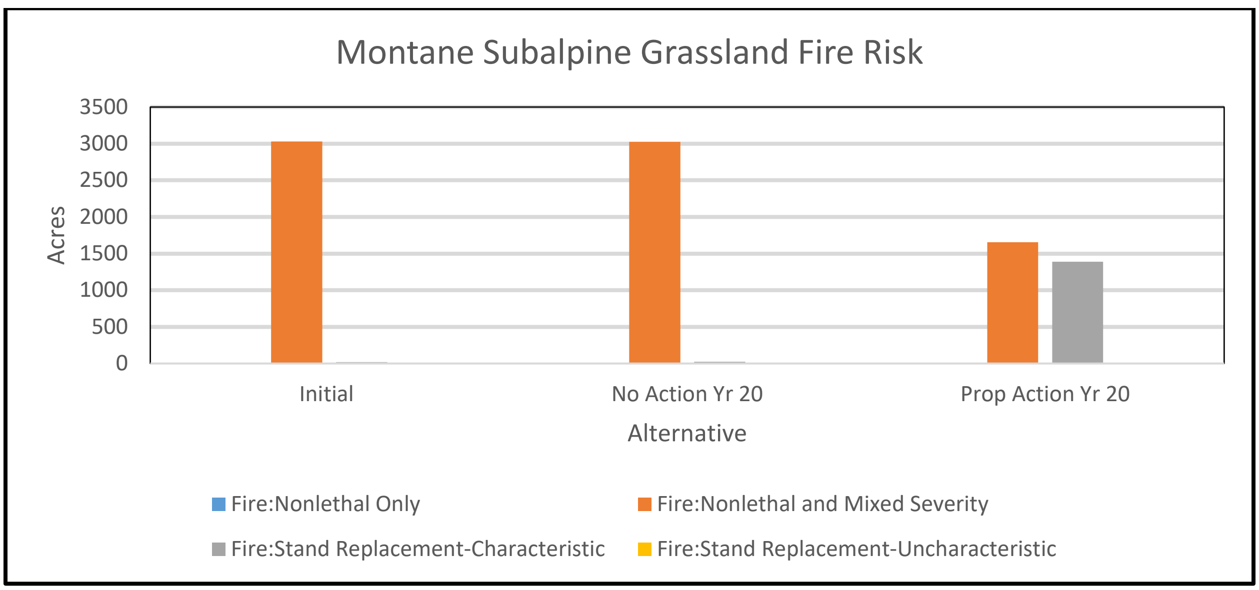

Figure 3-10. Montane Subalpine Grassland fire risk under all alternatives.

Alternative A – No Action

Under the no action alternative, the proposed forest restoration activities would not occur within the project area.

This ecological response unit is naturally maintained by disturbance like wildfire. With fire suppression and an absence of disturbance from thinning or prescribed fire treatments, encroaching shrubs and trees, and potentially invasion by nonnative species would continue, this would result in short-term (one to two growing seasons) and long-term (greater than 2 years) adverse impacts as the abundance and quality of grasslands dwindle. There would be no long-term beneficial impacts derived from the lack of restoration treatments to maintain and restore grassland communities.

If hazardous fuels are not maintained through mechanical and manual treatments, areas would become more prone to high-intensity wildfire. Suppression activities that would include creation of fire lines and use of heavy equipment would result in the removal of vegetation and other impacts to vegetation from trampling, destruction of root systems, and compaction or removal of soils. These impacts would be short term (lasting one to two growing seasons) and adverse, but impacts would be mitigated by limiting fire line construction and conducting site rehabilitation.

The Montane Subalpine Grassland ecological response unit is a climax vegetation community that is dominated by herbaceous perennial grasses. At lower elevations, surface wildfire maintains the grassland from encroachment by conifer trees, but at higher elevations tree encroachment is less common due to winter cold extremes. Succession generally involves grass species replacement following disturbance. Kentucky bluegrass replaces typical climax grass species such as Thurber and Arizona fescues in response to heavy livestock grazing, and Kentucky bluegrass may become a climax species (Dick-Peddie 1993). Warming temperatures and drought may enhance trees and shrubs with deeper roots to become established, and cause shifts in current grass species compositions to lower-elevation species. Continued wildfire suppression would enhance tree and shrub encroachment in lower-elevation Montane Subalpine Grassland. Currently 99 percent of this ecological response unit is considered tree encroached.

Alternative B – Proposed Action

Vegetation Thinning

Free thinning treatment would be applied to 1,000 acres of the Montane Subalpine Grassland ecological response unit. This treatment would focus on removal of encroaching vegetation, returning the area to a desired condition of native species–dominated open grass and shrubland. Mechanical and manual treatments would restore healthy, diverse native grasslands and shrublands with varied species composition of grass, forbs, and shrubs over the long term (greater than 2 years), providing long-term beneficial impacts to grassland health.

Use of Fire

Prescribed fire (broadcast burning and pile burning) would be used to treat 1,151 acres of the Montane Subalpine Grassland ecological response unit. Prescribed fire would be applied with moderate intensity in tree-encroached areas to reduce encroachment on the margins of grassland areas. By controlling encroachment of woody species, broadcast burning would improve, restore, and maintain more open grassland communities in the short term (less than 2 years) and long term (greater than 2 years).

Continued application of broadcast burning would promote the growth of native grasses and forbs, by increasing seed production, germination, and establishment through increased cycling of plant nutrients. Many species occurring throughout the project area would be expected to have increased production following fire, including Arizona fescue and pine dropseed. The beneficial impacts of broadcast burning for restoring and maintaining grasslands would be both short-term (one to two growing seasons) and long-term (decades). The duration and degree of beneficial impacts would be influenced by the frequency of prescribed fires, the season of the burn, the number of acres burned during each cycle, and the vegetation types burned. Adaptive management would be applied throughout the life of the project to ensure that treatments are moving Montane Subalpine Grassland closer to desired conditions. Periodic monitoring would be applied throughout the project area, and monitoring results would be documented and reviewed to determine whether adjustments in design features should be made to maintain or improve resource conditions.

Mixed Conifer-Frequent Fire Forest

Affected Environment/Existing Conditions

The Mixed Conifer-Frequent Fire forest vegetation community is transitional with increasing elevation between ponderosa pine and Mixed Conifer with Aspen forests and generally occurs at elevations ranging from approximately 7,000 to 9,500 feet. Mixed Conifer-Frequent Fire forests are dominated by mainly shade-intolerant trees such as ponderosa pine, southwestern white pine, quaking aspen, and Gambel oak, with a lesser presence of shade-tolerant species such as white fir and blue spruce. Mid- tolerant species such as Douglas-fir are common. Aspen may occur as individual trees or small groups. This forest vegetation community typically occurs with an understory of grasses, forbs, and shrubs. Dick-Peddie (1993) provides detailed descriptions of the plant species compositions, the seral stages of ecological succession, and the processes causing succession for the Mixed Conifer-Frequent Fire ecological response unit under the classifications: Subalpine and Upper Montane Coniferous Forests, and within class dominant species associations or series that occur in warmer and drier environments, especially the White Fir-Douglas-fir-Ponderosa Pine and Douglas-fir-Gambel Oak Series. Succession in Mixed Conifer-Frequent Fire forests was historically initiated by mixed-severity wildfire and insect and disease mortality, and Gambel oak is a dominant early seral species.

Mixed Conifer-Frequent Fire ecological response unit vulnerability to climate-induced environmental stress across the Lincoln National Forest (percent of total unit landscape) over the next 20 years is: Low Vulnerability 0 percent; Moderate Vulnerability 28 percent, High Vulnerability 47 percent, and Very High Vulnerability 25 percent (see Figure 3-4) (U.S. Forest Service 2017c).

The composition, structure, and spatial pattern in Mixed Conifer-Frequent Fire forests were predominantly maintained by frequent, low-severity surface fires. The mean fire return interval in the Mixed Conifer-Frequent Fire vegetation community is approximately 4 to 8 years (Kaufmann and others 2007), though less frequent mixed-severity fires also occurred.

Table 3-6 outlines the condition of Mixed Conifer-Frequent Fire forests within the project area and illustrates the composition of seral states within the Mixed Conifer-Frequent Fire ecological response unit by acre.

Table 3-6. Mixed Conifer-Frequent Fire Forest Indicators, Existing Condition

Mixed Conifer Frequent Fire Seral Stage	Acres	Vegetative Structural Stage	Trees per Acre	Basal Area	Canopy Cover (%)	Crown Base Height (feet)	Fuel Loading (tons/acre)	Crowning Index (miles/hour)	Torching Index (miles/hour)	Fire Regime Condition Class (1 through 3)
Medium Large Closed	41,288	3/4/5	379	172	54	6.6	53	19	0	3
Medium Large Open Multi-Story	859	4/5	238	66	25	12.7	19	46	13	1
Medium Large Open Single Story	2,170	4	148	65	23	19.7	17	42	27	1
Small Closed	689	3	660	156	62	4.7	41	18	0	3
Small Open	2,676	2	180	45	21	6.4	45	32	6	1
Grass/Brush/ Sapling	9,931	1	723	84	44	5.0	33	27	1	2
Total	**57,613**									

The majority (72 percent) of Mixed Conifer-Frequent Fire forest under the existing condition falls within the medium large closed seral state (see). More open-canopy states are rare within the project area. The medium-large closed state is characterized by dense stand structure with high numbers of trees per acre, high basal areas, and closed canopies with high canopy cover. Closed canopies and overcrowding results in competition for growing space which affects the tree roots' ability to obtain water and nutrients from the soil and affects tree canopies' and understory plants' ability to capture sunlight. Overall, high tree densities reduce the growth and vigor of individual trees and increases the likelihood trees would be negatively impacted by pests, diseases, and poor health, ultimately leading to tree mortality (Abella and others 2007). The Western spruce budworm is a major defoliating insect of white fir, Douglas-fir, and blue spruce trees in the project area. Those species of conifer trees are more susceptible to outbreaks and to mortality from Western spruce budworm when stands are overgrown and individual trees are less able to chemically defend themselves from the budworms (Dick-Peddie 1993).

The predominance of the medium large closed seral state in the Mixed Conifer-Frequent Fire ecological response unit, results in increased potential for catastrophic fire. Existing conditions of high fuel loading and low crowning index makes these stands vulnerable to high-severity wildfire, for example 73 percent of the Mixed Conifer-Frequent Fire forest in the project area is susceptible to crown fire at winds speeds of less than 20 miles per hour. Under desired conditions, only 16 percent of the ecological response unit would be susceptible to crown fire with winds less than 20 miles per hour. The Fire Regime Condition Class data also suggest that 73 percent of the Mixed Conifer-Frequent Fire ecological response unit have fire regimes that are substantially departed from the historical fire regime. Areas in Class 3 that experience fire have the potential to result in dramatic changes in fire size, fire intensity and severity, and landscape pattern.

Environmental Consequences

The effects of implementing the no action alternative and the proposed action are presented below in Table 3-7 and Figure 3-11.. Impacts common to all alternatives are described above. Specific impacts to the Mixed Conifer-Frequent Fire ecological response unit are described below.

The no action alternative and proposed action are presented in the same table and graphs for comparison. As the reader moves down the rows in Table 3-7, for the different seral states that make up the Mixed Conifer-Frequent Fire ecological response unit, the associated stand structure for that seral state (i.e., vegetation structural state, trees per acre, basal area, etc.) changes. The first column in the table shows the acreages within each seral state at year 0 (the existing condition). Column two shows how after 20 years of no action, the acres within each seral state would be distributed. Column three shows how after 20 years of the proposed action, the acreages in each state shift, with fewer acres within the medium large closed state and those acres instead distributed between the medium large open multi-story and medium large open single-story states. Generally, this means that the proposed action would result in more open stands with less interlocking canopies, with fewer small-diameter trees and a greater number of larger-diameter older trees.

The remaining columns in Table 3-7 describe the stand structure characteristics for each state, which do not vary by alternative. The graph (see Figure 3-11) shows the redistribution of acres of Mixed Conifer-Frequent Fire forest states between each seral state under the no action and proposed action, relative to the existing condition

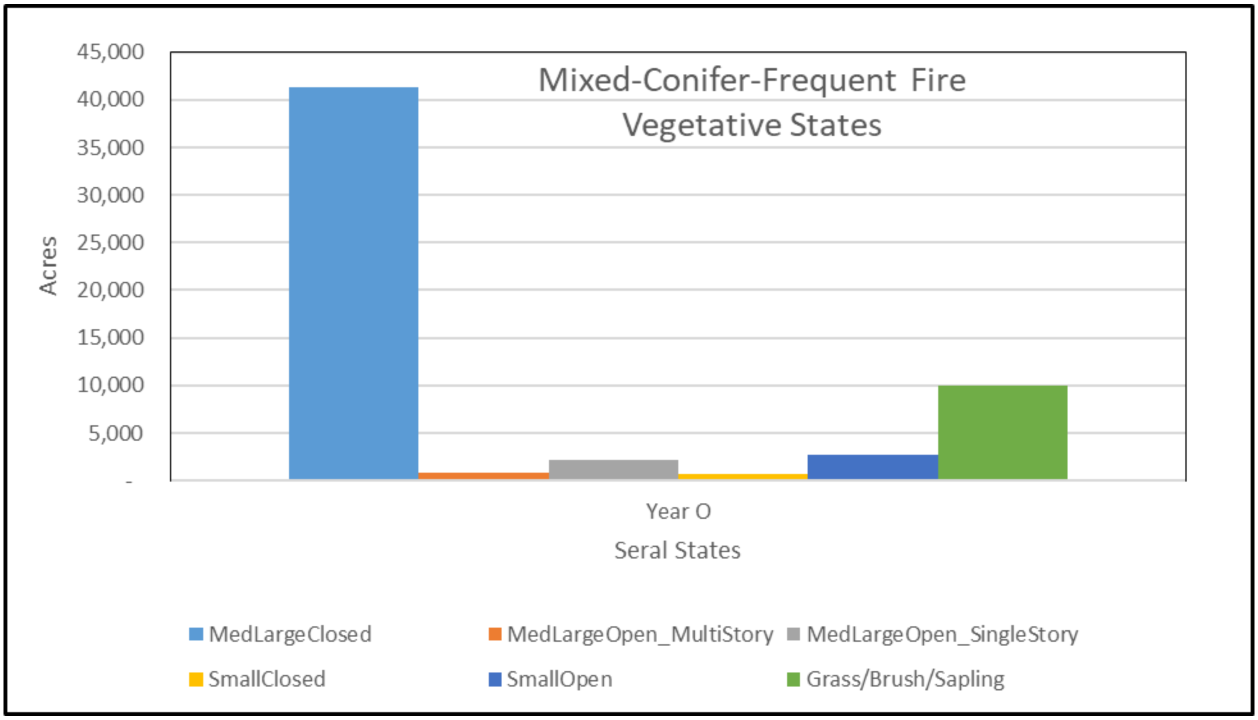

Figure 3-11. Composition of seral states for existing Mixed Conifer-Frequent Fire within the South Sacramento Restoration Project Area.

Table 3-7. Indicators for the Mixed Conifer-Frequent Fire Ecological Response Unit under the No Action and Proposed Action, Relative to the Existing Condition

Mixed Conifer-Frequent Fire Seral Stage	Acres Year 0	Acres No Action Year 20	Acres Proposed Action Year 20	Vegetative Structural Stage	Trees per Acre	Basal Area	Canopy Cover (%)	Crown Base Height (feet)	Fuel Loading (tons/acre)	Crowning Index (miles/hour)	Torching Index (miles/hour)	Fire Regime Condition Class
Medium Large Closed	41,288	40,243	18,120	3/4/5	379	172	54	6.6	53	19	0	3
Medium Large Open Multi-Story	859	558	13,824	4/5	238	66	25	12.7	19	46	13	1
Medium Large Open Single Story	2,170	1,377	7,800	4	148	65	23	19.7	17	42	27	1
Small Closed	689	3,587	3,050	3	660	156	62	4.7	41	18	0	3
Small Open	2,676	56	188	2	180	45	21	6.4	45	32	6	1
Grass/Brush/Sapling	9,931	11,791	14,629	1	723	84	44	5.0	33	27	1	2
Total	**57,613**	**57,612**	**57,611**									

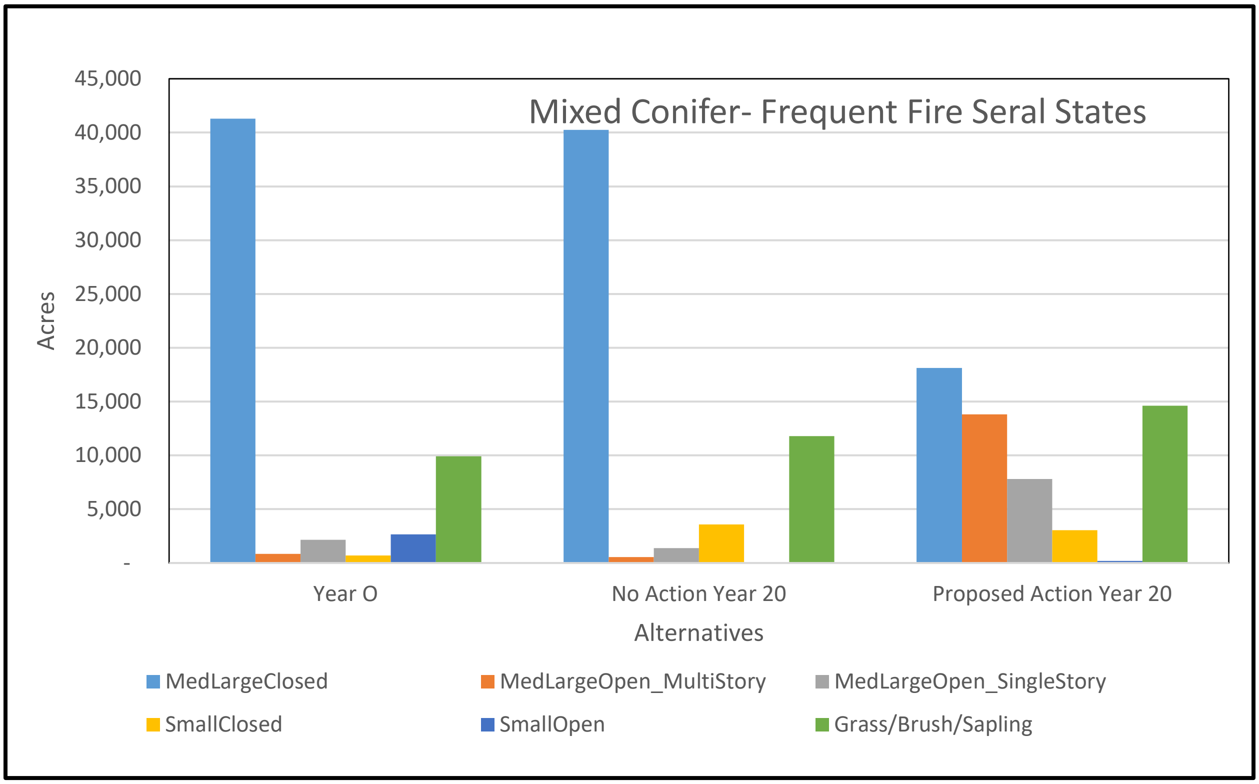

Figure 3-12. Composition of seral states for Mixed Conifer-Frequent Fire within the South Sacramento Restoration Project Area under the no action and proposed action, relative to the existing condition.

Alternative A – No Action

Under the no action alternative, the proposed forest restoration activities would not occur within the project area. Therefore, no long-term beneficial impacts to Mixed Conifer-Frequent Fire vegetation communities, fire, and fuels would occur.

After 20 years, the majority of the states within the ecological response unit would be composed of medium large closed state Mixed Conifer-Frequent Fire and a slightly greater number of acres would be composed of small closed state Mixed Conifer-Frequent Fire forest vegetation, compared with the existing condition, illustrating a nearly static, stagnated condition of the forest.

In the absence of restoration treatment, therefore, the Mixed Conifer-Frequent Fire ecological response unit is predicted to remain within an unhealthy condition relative to desired conditions due to a predominance of dense states with high numbers of trees per acre, closed and interlocking canopies, high fuel loading of surface and canopy fuels, low crowning and torching index, and significant departure from historical fire regime. Under these conditions, fires would burn with active crown fire, with extreme spread rates and flame lengths, which would limit the ability of fire fighters to suppress the fire safely. Therefore, large number of acres would potentially undergo stand replacement (see Figure 3-15. Extreme fire behavior is uncharacteristic of species making up the Mixed Conifer-Frequent Fire ecological response unit. Severe wildfire has the potential to not only consume large areas of standing native vegetation, but also remove seed banks, damage soils, interfere with natural hydrological processes, and create large areas of exposed soil, making the areas vulnerable to increased nonnative invasive plant species establishment. Over time (decades) there would be a shift to early successional species and a change in the structure and function of the community; impacts would be severe, adverse, and long lasting (decades).

The ecological response unit would exhibit a continuing high competition for resources, poor individual tree vigor and growth, and a continuation of poor overall forest health conditions and a decreasing resilience to insects and disease. According to projected insect and disease risk (see Figure 3-13.), the incidence of moderate insect and disease outbreaks in the Mixed Conifer-Frequent Fire ecological response unit, is expected to almost quadruple in 20 years of the no action.

As fire regimes are altered, nonnative invasive species would continue to displace native vegetation. Species diversity would continue to decline as shade-tolerant species become dominant and alter species composition (Fulé and Laughlin 2007), particularly in the understory, with projected decline of the grass, forb, shrub matrix (Reynolds and others 2013). In the long term (decades), stand structure would become more homogenous with reduced structural and spatial heterogeneity as even-aged forest structure dominate the landscape scale; impacts of the no action would be continued decline of forest health, reduced resiliency, and impaired ecosystem process.

The lack of treatments would result in short-term (one to two growing seasons) and long-term (decades) adverse impacts as forest health declines, and beneficial impacts that would come from restoration treatments in Mixed Conifer-Frequent Fire forest stands would not be realized.

To show impact to Old Growth, a breakdown of the four seral states containing mature and old forest states is shown in Figure 3-14. and Table 3-8. These states are split apart from the medium seral (young and mid-aged forest) and the large tree seral states (mature and old forest) used in the broader analysis and expanded to show all of the large tree structural states (open/closed, multi/single story).

Currently only 316 acres (0.6 percent) are in the mature and old forest seral states, states containing Old Growth components.

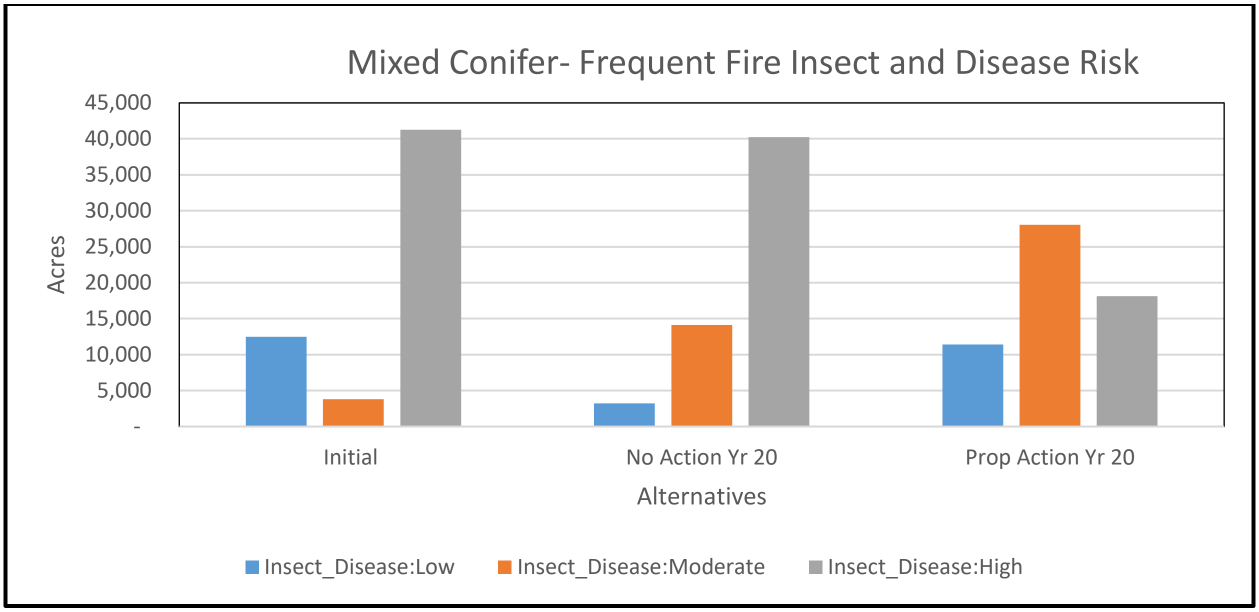

Figure 3-13. Modeled insect and disease ratings for the Mixed Conifer-Frequent Fire ecological response unit under each alternative, compared with existing conditions.

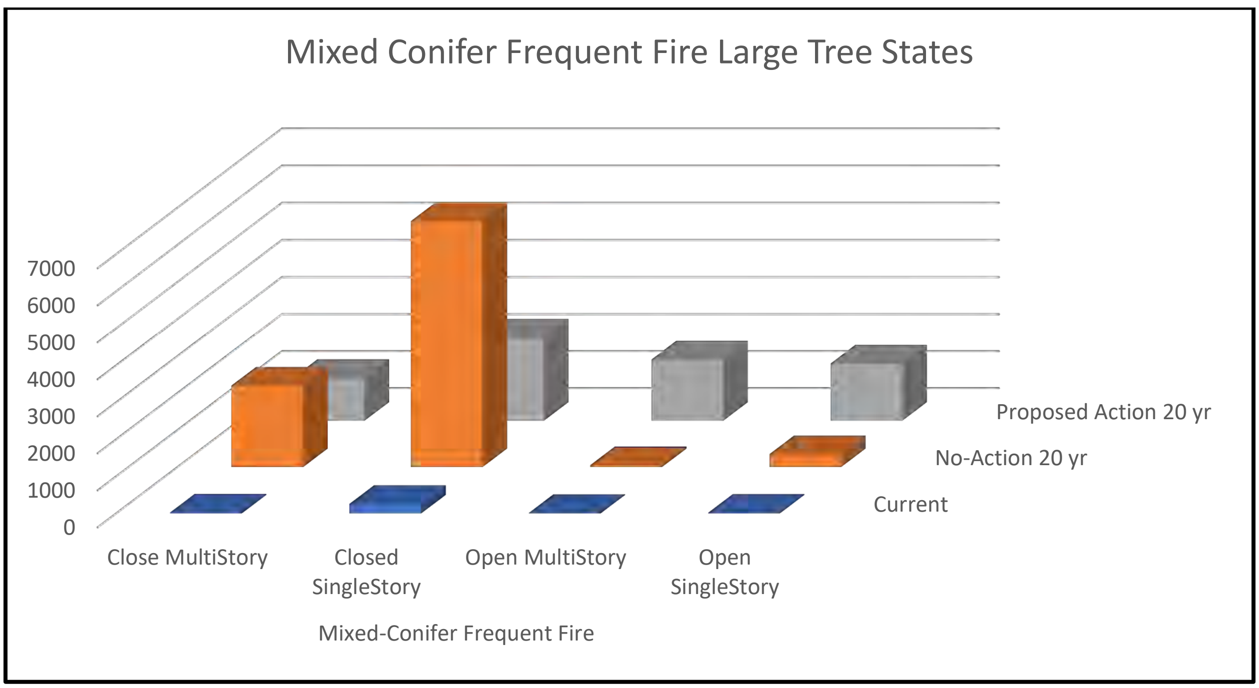

Figure 3-14. Mixed-Conifer Frequent Fire large tree states (Vegetative Structural Stages 5 and 6) current conditions, no action, and proposed action.

Under the no action alternative, states containing Old Growth increase to 9,241 acres (16 percent) over the next 20 years, primarily as transition from medium-size tree states stemming from tree growth (see Table 3-8). Most of this increase (72 percent) is in the closed single-storied state, the least resistant state to crown fire.

Table 3-8. Mixed-Conifer Frequent Fire Large Tree States (Vegetative Structural Stages 5 and 6) Current Conditions, No Action, and Proposed Action

Mixed-Conifer Frequent Fire	Current Condition	No Action at 20 years	Proposed Action at 20 years
Close Multi-Story	24	2,202	1,157
Closed Single Story	258	6,637	2,250
Open Multi-Story	14	52	1,657
Open Single Story	20	350	1,549
Total	**316**	**9,241**	**6,613**

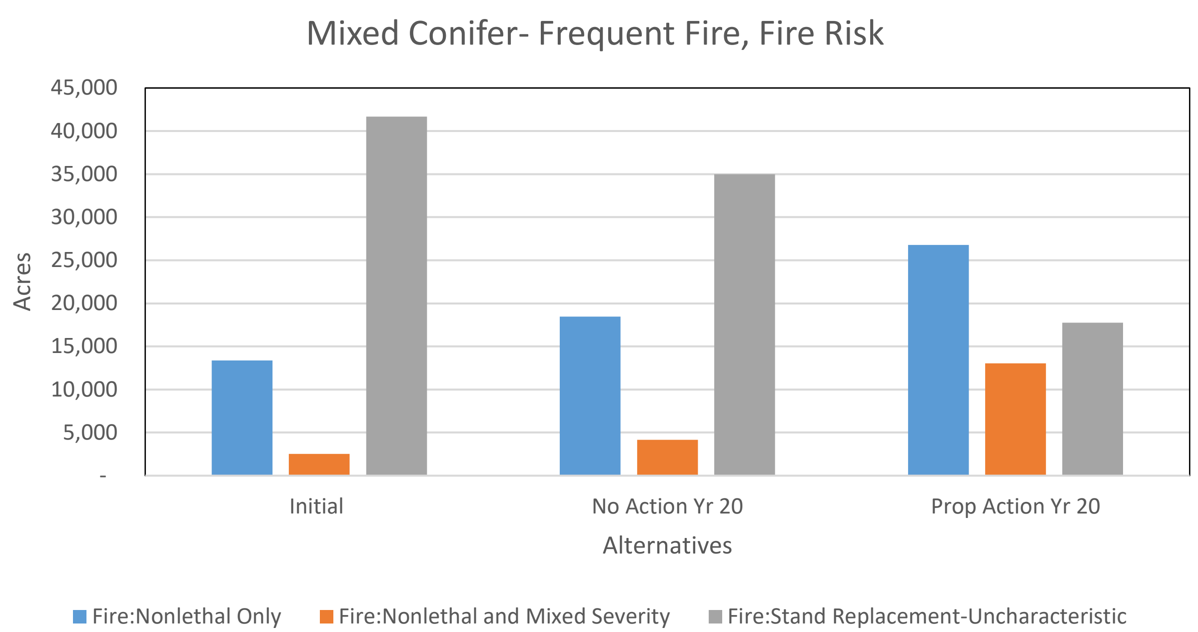

Figure 3-15. Modeled fire risk to Mixed Conifer-Frequent Fire ecological response unit under each alternative, compared with the existing conditions.

<u>Alternative B – Proposed Action</u>

Vegetation Thinning

Under the proposed action, silvicultural treatments would impact 21,228 acres of the Mixed Conifer-Frequent Fire forest ecological response unit. After 20 years of treatments the composition of seral states within the Mixed Conifer-Frequent Fire forest ecological response unit is more variable, compared with the existing condition. There is a shift from a dominance by a single age class, in the form of the medium-large closed state, toward greater acres within the medium large open multi-story and medium large open single-story states. There is also an increase in grass/brush/sapling acreage due to the opening of the canopy. The resulting forest states more closely resemble the desired condition for the Mixed Conifer-Frequent Fire forest ecological response unit, which is characterized by fewer trees per acre, reduced basal area and stand density index, and reduced canopy cover. The proposed action would result in a mosaic of structural ages, greater “clumpiness” and a more functional ecosystem containing all components, processes, and conditions. The multi-story structure promotes increased resilience to disturbance, climate variability, and disease. The heterogeneous structure provides greater habitat variability and structural components to suit a wide range of plant and wildlife species.

Reductions in tree densities would result in more sunlight and plant nutrient resources for other plant species, especially understory plants, and would increase the canopy cover, productivity, and diversity of other native plant species, similar to desired historic reference conditions.

Modeling under the proposed action predicts over a 50 percent reduction in the risk of high rates of insect and disease infestation at 20 years, compared with the no action alternative; treatments would remove the least healthy trees, improve stand vigor by reducing competition, and treat stands that have dwarf-mistletoe infestations that impact forest vigor and increase tree mortality (Kaufmann and others 1998). Selective treatments favoring the removal of small infested trees and opening up dense stands, would mitigate the spread of pathogens and insects, especially dwarf mistletoe, reducing future infestation (Hessburg and Beatty 1986), and improving the overall health and resiliency of residual stands in the long term (greater than 2 years).

Thinning treatments would result in reduced trees per acre, improving species composition and meeting desired conditions for stand density. Open stand structures would favor maintaining larger trees, especially shade-intolerant species like Douglas-fir and ponderosa pine. Tree vigor and growth would be enhanced by the application of all vegetation thinning treatments, though most notably by group selection with matrix thinning which would be used to treat 14,843 acres of the medium large closed and medium large open stages of the ecological response unit, creating uneven-aged structure and patchiness. Free thinning would be used to treat 2,410 acres of the medium large closed stages in order to remove the least-healthy trees, break up the continuity of the canopy and favor shade-intolerant species. Thin from below would be used to treat 3,975 acres removing small-diameter, unhealthy, and suppressed trees that make up the small closed, small open, and sapling stages. The residual uneven-aged stand structures would provide long-term (decades) beneficial impacts for forest health and resilience.

Mixed Conifer-Frequent Fire forest is characterized as a frequent low-severity fire regime; for example, Brown and others (2001) found that the mean fire return interval for the Sacramento Mountains is 5.4 years ± 3.4 years. Modeling of predicted fire risk shows that under the proposed action, at 20 years the number of acres of potential stand-replacing, uncharacteristic wildfire is reduced by over half when compared with the existing condition. By reducing stand densities, increasing crown base heights and shifting acres from a medium large closed state to a medium open multi-story and single-story state, the Fire Regime Condition Class shifts from a 3 to a 1 or 2, reducing the acreage of Mixed Conifer-Frequent Fire forest vegetation that is currently extremely departed from the natural range of variability. The acres of non-lethal fire are expected to increase, suggesting the states move closer toward their historic fire regime of frequent, low-severity wildfire. Under a moderated fire regime, potential high mortality resulting from an unplanned ignition would be reduced and long-term (decades) adverse impacts would be avoided.

Under the proposed action alternative, states containing Old Growth increase to 6,613 acres (11.5 percent of total ecological response unit) over the next 20 years, primarily transitioning from medium-size tree states stemming from tree growth and treatments (see Table 3-8). This increase is spread evenly between all four states, providing a more diverse range of structural classes, the two open states (3,206 acres [48 percent]) are much more resistant to loss from crown fire and threats from insects, primarily bark beetles, and are expected to be more sustainable over time.

Use of Fire

Prescribed fire (broadcast burning and pile burning) would be used to treat 49,751 acres of the Mixed Conifer-Frequent Fire ecological response unit, typically following vegetation thinning treatments. All forms of prescribed fire treatment may be applied.

Prescribed fire prescriptions would be established so that fire intensity is carefully managed in order to meet desired conditions characteristic of a mixed-severity fire regime. All seral stages of Mixed Conifer-Frequent Fire would be treated with low-intensity wildfire and the medium-large closed state would also be treated with prescribed fire under moderate conditions, increasing tree mortality and opening up the stand, in order to meet desired conditions (U.S. Forest Service 2018a).

Broadcast burning, particularly under moderate intensities as proposed under this alternative, can be effective at controlling dwarf mistletoe infestations that have been prevalent in Mixed Conifer-Frequent Fire forests; the effectiveness of the treatment depends on whether infected trees are scorched or killed to prevent mistletoe spread (Harrington and Hawksworth 1990). Monitoring and adaptive management would be implemented to improve treatment effectiveness.

Broadcast burning could result in the loss of individuals and communities of plants for up to two growing seasons post fire. Ponderosa pine is a fire-adapted/resistant species due to its thick bark, deep roots, and relatively high and open growth habit (Allen and others 2002) and ponderosa pine seedling establishment is favored when fire removes forest floor litter (Kane and other 2010). Therefore, a ponderosa pine community would recover relatively quickly from prescribed burns. In the long term, Mixed Conifer-Frequent Fire forest species would benefit from prescribed fire, since the understory would be thinned, litter converted to nutrients, and initial steps taken to reestablish a natural fire regime.

Following broadcast burning, Gambel oak may occupy the post-fire successional stage within the stand and may persist for several decades before it becomes shaded out by the coniferous overstory (Brady and Bonham 1976; Hanks and Dick-Peddie 1974). Douglas-fir and ponderosa pine tend to be the first conifers to colonize sites at mid-succession, altering the understory in favor of shade-tolerant herbs and shrubs and continued colonization by Douglas-fir, ponderosa pine, and southwestern white pine species.

The removal of residual fuels following thinning treatments would reduce hazardous fuel loading and by emulating wildfire, broadcast burning would help the Lincoln National Forest move closer to the goal of promoting the role of fire in these fire-adapted Mixed Conifer-Frequent Fire forests. The continued application of broadcast burning, and the use of adaptive management concepts to improve treatment effectiveness, would result in long-term (decades) benefits as a more open overstory and a perennial herbaceous understory would develop on most sites, bringing stands closer to desired conditions for the Mixed Conifer-Frequent Fire vegetation community. Over time, more pronounced increases in species richness, diversity, and resiliency would occur with a tendency toward fire-tolerant plant species across the affected landscape. Fire regimes would be reduced to a lower condition class across the ecological response unit, providing long-term (decades) beneficial impacts to stand resiliency to uncharacteristic wildfire.

Adaptive management would be applied throughout the life of the project to ensure that treatments are moving Mixed Conifer-Frequent Fire forests closer to desired conditions. Periodic monitoring would be applied throughout the project area, and monitoring results would be documented and reviewed to determine whether adjustments in design features should be made to maintain or improve resource conditions.

Ponderosa Pine Forest

Affected Environment/Existing Conditions

Ponderosa pine communities generally occur at elevations ranging from approximately 6,000 to 9,000 feet. Ponderosa pine is one of the most fire-adapted conifer species in the West, and its resistance to surface fire increases as trees age. Ponderosa pine is the dominant seral and climax tree species in

Southwest ponderosa pine forests. Depending on locale, ponderosa pine forests commonly include other species such as oak, juniper, and pinyon. More infrequent species such as aspen, Douglas-fir, white fir, or southwestern white pine may also be present. These become more common with elevation and in cooler sites as Ponderosa Pine Forests transition into Mixed Conifer-Frequent Fire ecological response unit.

This forest vegetation community typically occurs with an understory of grasses and forbs, although it sometimes includes shrubs. Understories dominated either by Gambel oak or wavy-leaf oak (*Quercus* ^{x}*pauciloba*), a natural hybrid of Gambel oak and Sonoran scrub oak (*Quercus turbinella*), can occur at lower elevations (Kaufmann and others 1998). Dick-Peddie (1993) provides detailed descriptions of the plant species compositions, the seral stages of ecological succession, and the processes causing succession for the ponderosa pine forest ecological response unit under Lower Montane Coniferous Forests; Ponderosa Pine-Gambel Oak, Ponderosa Pine-Pinyon Pine-Gambel Oak, and Ponderosa Pine-Pinyon Pine-Gray Oak Series.

Ponderosa Pine Forest ecological response unit vulnerability to climate-induced environmental stress across the Lincoln National Forest (percent of total unit landscape) over the next 20 years is: Low Vulnerability 0 percent; Moderate Vulnerability 5 percent, High Vulnerability 22 percent, and Very High Vulnerability 72 percent (see Figure 3-4) (U.S. Forest Service 2017c).

The mean fire return interval among ponderosa pine–dominated vegetation communities is approximately every 4 years. From the late 1600s until 1800, fires in the ponderosa pine–dominated forests and lower mixed conifer forests of the Sacramento Mountains were small and patchy in distribution, as evidenced by the scarring of only a few scattered trees (Wilkinson 1997). After 1800, fires scars were more synchronous over larger areas, a pattern that ceased around 1900 (Kaufmann and others 1998). The four ponderosa sites in the Brown study (Brown and others 2001) of fire history in the Sacramento Mountains found Mean Fire Return Intervals ranging from 2.6 years to 6.6 years with a standard deviation ranging from +/- 1.8 years to +/- 2.8 years.

The majority of the ecological response unit is classified as medium large closed state (Table 3-9 and Figure 3-16.). The existing conditions of the stands therefore have a predominance of young to middle-aged forest, with high numbers of trees per acre, high basal areas, and 50 percent canopy cover and higher. The crowning index is low, meaning that crown fire could be initiated at low wind speeds, under 30 miles per hour.

Table 3-9. Ponderosa Pine Forest Indicators, Existing Condition

Ponderosa Pine Forest Seral Stage	Acres	Vegetative Structural Stage	Trees per Acre	Basal Area	Canopy Cover (%)	Crown Base Height (feet)	Fuel Loading (tons/acre)	Crowning Index (miles/hour)	Torching Index (miles/hour)	Fire Regime Condition Class
Medium Large Closed	7,079	3/4/5	348	168	50	20	17	30	41	3
Medium Large Open Multi-Story	190	4/5	185	70	24	20	8	56	25	1
Medium Large Open Single Story	749	4	97	58	21	21	10	51	24	1
Small Closed	580	3	691	147	55	12	13	31	31	3
Small Open	2,180	3	217	45	23	12	10	54	12	1
Grass/Brush/Saplings	3,603	2	733	75	37	6	6	40	4	2
Total	**14,381**									

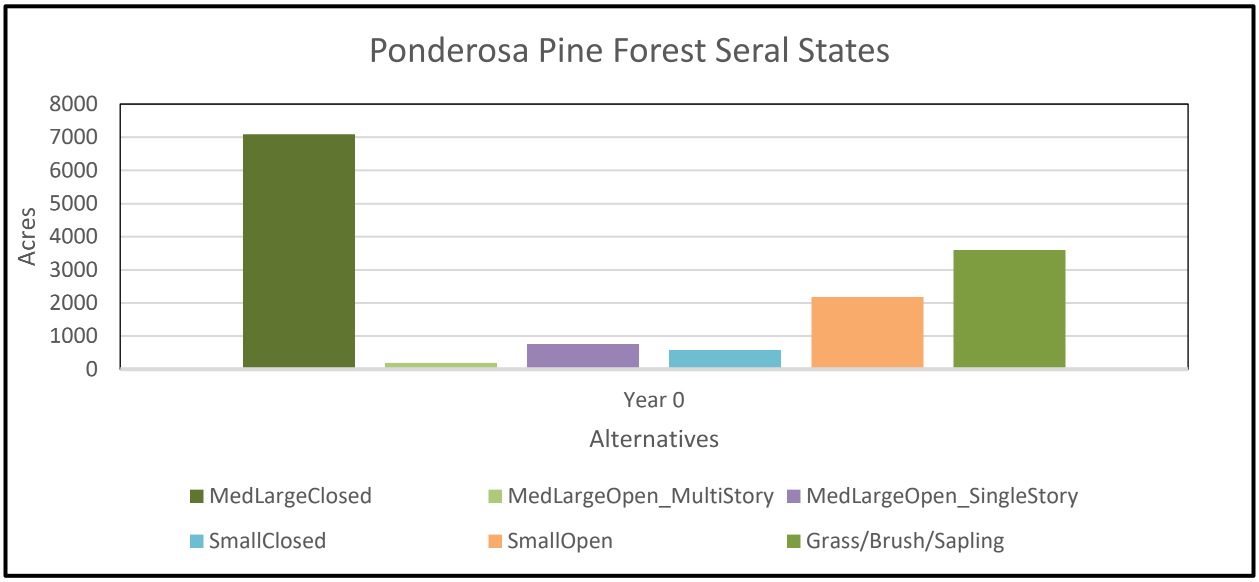

Figure 3-16. Composition of seral states for existing Ponderosa Pine Forest within the South Sacramento Restoration Project Area.

<u>Environmental Consequences</u>

The effects of implementing the no action alternative and the proposed action are presented below in Table 3-10 and Figure 3-17. Impacts common to all alternatives are described above. Specific impacts to the Ponderosa Pine Forest ecological response unit are described below.

The no action alternative and proposed action are presented in the same table and graphs for comparison. As the reader moves down the rows in Table 3-10 for the different seral states that make up the Ponderosa Pine Forest ecological response unit, the associated stand structure for that seral state changes (i.e., vegetation structural state, trees per acre, basal area, etc.). The first column in the table shows the acreages within each seral state at year 0 (the existing condition). Column two shows how after 20 years of no action, the acres within each seral state would be distributed. Column three shows how after 20 years of the proposed action, the acreages in each state shift, with fewer acres within the medium-large closed state and those acres instead distributed relatively evenly between all seral states (see Figure 3-17). Generally, this means that the proposed action would result in forests with more diversity in age and size classes, with more open states and a higher number of larger, older trees instead of a predominance of young small-diameter trees in the understory.

The remaining columns in Table 3-10 describe the stand structure characteristics for each state, which do not vary by alternative. The graph (see Figure 3-17.) shows the redistribution of acres of ponderosa pine states between each state under the no action and proposed action, relative to the existing condition.

Table 3-10. Indicators for the Ponderosa Pine Forest Ecological Response Unit under the No Action and Proposed Action, Relative to the Existing Condition

Ponderosa Pine Forest Seral Stage	Acres Year 0	Acres No Action Year 20	Acres Proposed Action Year 20	Vegetative Structural Stage	Trees per Acre	Basal Area	Canopy Cover (%)	Crown Base Height (feet)	Fuel Loading (tons/acre)	Crowning Index (miles/hour)	Torching Index (miles/hour)	Fire Regime Condition Class
Medium Large Closed	7,079	7,352	2,694	3/4/5	348	168	50	20	17	30	41	3
Medium Large Open Multi Story	190	284	3,277	4/5	185	70	24	20	8	56	25	1
Medium Large Open Single Story	749	513	1,858	4	97	58	21	21	10	51	24	1
Small Closed	580	3,112	1,875	3	691	147	55	12	13	31	31	3
Small Open	2,180	841	2,076	3	217	45	23	12	10	54	12	1
Grass/Brush/Saplings	3,603	2,279	2,601	2	733	75	37	6	6	40	4	2
Total	**14,381**	**14,381**	**14,381**									

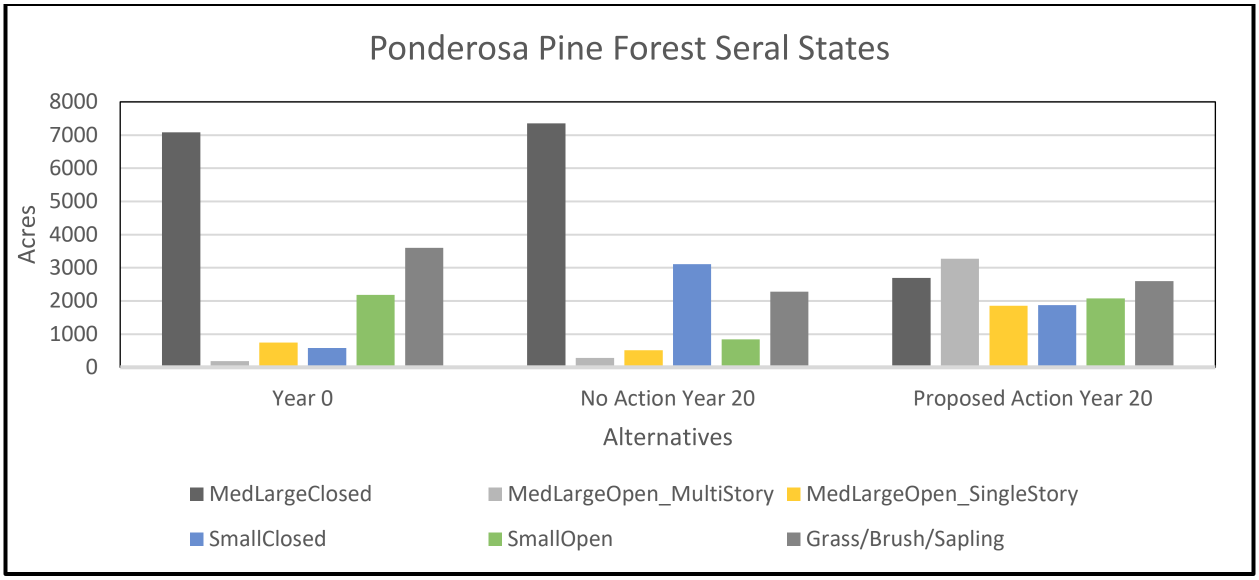

Figure 3-17. Composition of seral states for Ponderosa Pine Forest ecological response unit within the South Sacramento Restoration Project Area under the no action and proposed action, relative to the existing condition.

<u>Alternative A – No Action</u>

Under the no action alternative, the proposed forest restoration activities would not occur within the project area. Therefore, no long-term beneficial impacts to Ponderosa Pine Forest vegetation communities, fire, and fuels would occur.

After 20 years, there would be a slight increase in the acreage of medium large closed states and just under 3,000 additional acres transitioning to small closed states. There would be a reduction in grass/brush/sapling seral states as small closed states increase. The ecological response unit would exhibit a continuing high competition for resources as small-diameter tree thickets of sapling-sized ponderosa pine increase, creating conditions that impede tree vigor and growth. There would be a continuation of poor overall forest health conditions and a decreasing resistance to insects and disease, with no reduction in wildfire risk, relative to existing conditions. The western pine beetle (Dendroctonus brevicomis), the roundheaded pine beetle (Dendroctonus adjunctus), and the pine engraver beetle (Ips pini) are three of the more important insects that can kill large numbers of ponderosa pine trees and reduce stand densities. Increased populations of pine bark beetles generally occur during drought conditions when trees are water stressed and not able to defend themselves from the beetles. Trees in overgrown stands, competing with other trees for water, and large trees that are more prone to water stress, are more likely to be killed by pine bark beetles. Pine bark beetles can eliminate mature climax stands of ponderosa pine, similar to the effects of crown-fires.

According to pprojected and disease rates (Figure 3-18 -Figure 3-19), the incidence of high rates of insect and disease outnreaks seen under the existing condition would not be mitigated.Modeling predicts much of the project area would be vulnerable to stand-replacement severity (Figure 3-19) that is characterized by crown fire with extreme spread rates and flame lengths, which would limit the ability of firefighters to suppress the fire safely (see Figure 3-20). Extreme fire behavior is uncharacteristic of species making up the Ponderosa Pine Forest ecological response unit; severe wildfire has the potential to not only consume large areas of standing native vegetation, but also remove seed banks, damage soils, interfere with natural hydrological processes, and create large areas of exposed soil, making the areas vulnerable to increased nonnative invasive plant species establishment. Over time (decades) there would be a shift to early successional species and a change in the structure and function of the community; impacts would be severe, adverse, and long lasting (decades).

The lack of restoration treatments in the Ponderosa Pine Forest ecological response unit would result in short-term (one to two growing seasons) and long-term (decades) adverse impacts as forest health declines, and beneficial impacts that would come from restoration treatments in ponderosa pine stands would not be realized.

To show impact to Old Growth, a breakdown of the four seral states containing mature and old forest stages is shown in Figure 3-18 and Table 3-11. These states are split apart from the medium seral (young and mid-aged forest) and the large tree seral states (mature and old forest) used in the broader analysis and expanded to show all of the large tree structural states (open/closed, multi/single story).

Currently only 36 acres (0.3 percent) are in the mature and old forest seral states, states containing 1,262 acres (8.8 percent of the ecological response unit) over the next 20 years, primarily due to a transition from medium-size tree states stemming from tree growth (see Table 3-11). Most of this increase (80 percent) is in the two closed states, the least-resistant state to crown fire and insect threats.

Table 3-11. Ponderosa Pine Forest Large Tree States (Vegetative Structural Stages 5 and 6) Current Conditions, No Action, and Proposed Action

Ponderosa Pine Forest	Current Condition	No Action at 20 Years	Proposed Action at 20 Years
Closed Multi-Story	2	404	282
Closed Single Story	10	600	174
Open Multi-Story	18	86	709
Open Single Story	6	172	524
Total	**36**	**1,262**	**1,689**

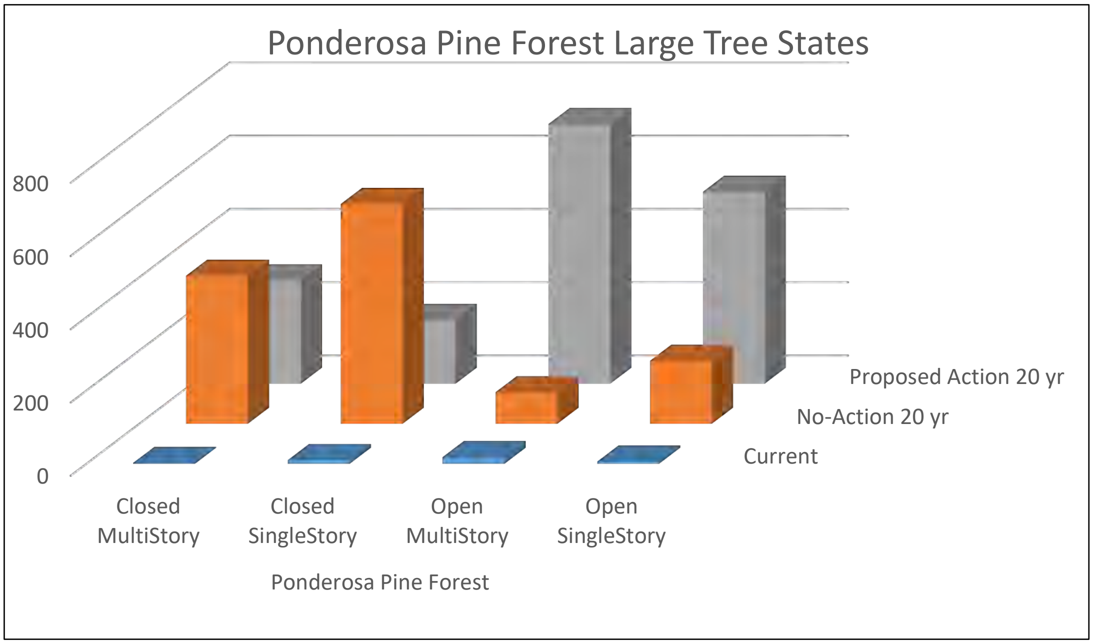

Figure 3-18.Ponderosa Pine Forest large tree states (Vegetative Structural Stages 5 and 6) current conditions, no action, and proposed action.

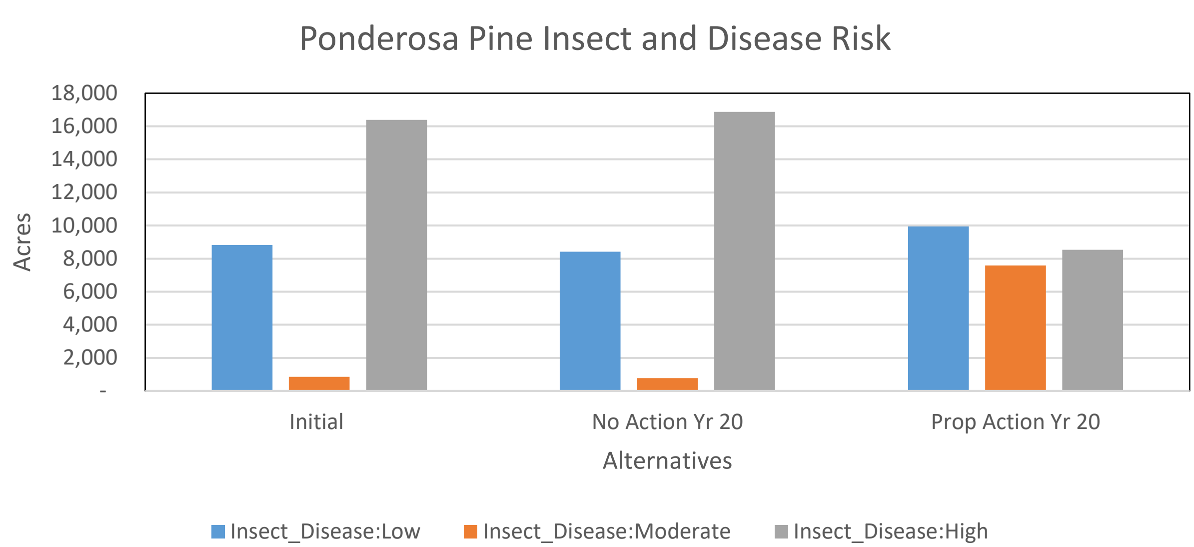

Figure 3-19. Modeled insect and disease ratings for the Ponderosa Pine Forest ecological response unit under each alternative, compared with existing conditions.

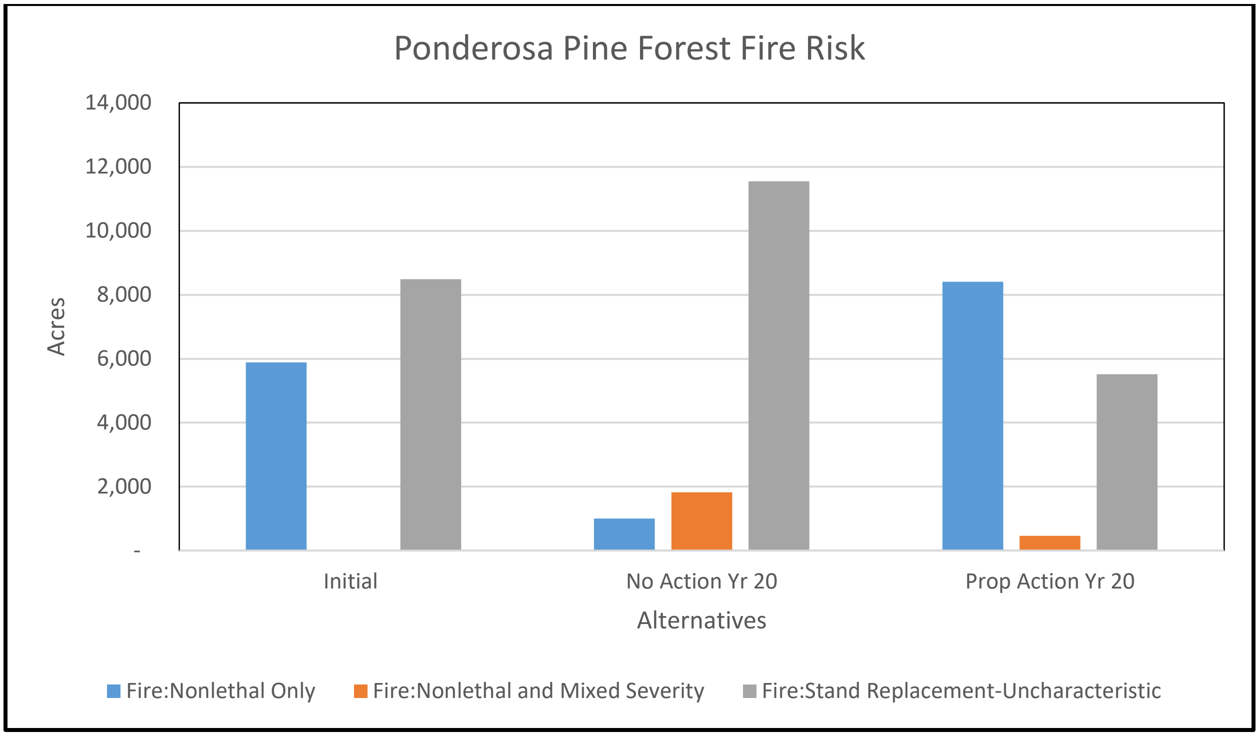

Figure 3-20. Modeled fire risk to Ponderosa Pine Forest ecological response unit under each alternative, compared with the existing conditions.

Alternative B – Proposed Action

Vegetation Thinning

Under the proposed action, silvicultural treatments would impact 8,093 acres of the Ponderosa Pine Forest ecological response unit. After 20 years of treatments, the composition of seral states within the Ponderosa Pine Forest ecological response unit is more variable, compared with the existing condition.

There is a shift from a dominance by a single age class, in the form of the medium-large closed state, toward greater acres within the medium large open multi-story and medium large open single-story states. There is also an increase in grass/brush/sapling acreage due to the opening of the canopy. Reductions in tree densities would result in more sunlight and plant nutrient resources for other plant species, especially understory plants, and would increase the canopy cover, productivity and diversity of other native plant species, similar to desired historic reference conditions.

Thinning treatments would result in reduced trees per acre, improving species composition and meeting desired conditions for stand density. Open stand structures would favor maintaining larger trees, especially shade-intolerant species like Douglas-fir and ponderosa pine and old growth. Tree vigor and growth would be enhanced by the application of all vegetation thinning treatments. Group selection with matrix thinning would be used to treat 3,527 acres of the ecological response unit, with focus primarily on the medium large closed and medium large open seral stages, creating uneven-aged structure and patchiness. Thin from below treatments would be used to treat 4,204 acres of the smaller open and closed seral stages, releasing larger trees from competition, promoting improved tree vigor and growth, reducing ladder fuels, and raising crown base heights to reduce potential for crown fire transmission. Free thinning would remove suppressed and unhealthy trees on 362 acres of the medium large closed seral stage, creating greater patchiness and heterogeneity in stand structure.

The resulting forest stands, more closely resemble the desired condition for the Ponderosa Pine Forest ecological response unit, which is characterized by fewer trees per acre, reduced basal area and stand density index, and reduced canopy cover. The proposed action would result in a mosaic of structural ages, greater “clumpiness” and a more functional ecosystem containing all components, processes and conditions. The multi-story structure promotes increased resilience to disturbance, climate variability, and disease. The heterogeneous structure provides greater habitat variability and structural components to suit a wide range of wildlife species. The residual uneven-aged stand structures provide long-term (decades) beneficial impacts for forest health and resilience.

Modeling under the proposed action predicts a 62 percent decrease in the risk of high rates of insect and disease infestation at 20 years, compared with the no action; treatments would remove the least healthy trees, improve stand vigor by reducing competition, and treat stands that have dwarf-mistletoe infestations that impact forest vigor and increase tree mortality (Kaufmann and others 1998). Selective treatments favoring the removal of small infested trees and opening up dense stands, would mitigate the spread of pathogens and insects, especially dwarf mistletoe, reducing future infestation (Hessburg and Beatty 1986), and improving the overall health and resiliency of residual stands in the long term (greater than 2 years).

Ponderosa Pine Forests are characterized as a frequent low-severity fire regime with fires occurring on an interval of 2 to 24 years. Fire behavior under the proposed action is predicted to be reduced in severity due to the reduced densities, increased distance to crowns, and increased heterogeneity in structure and size class. Modeling of predicted fire risk shows that under the proposed action, at 20 years the number of acres of potential stand-replacing, uncharacteristic wildfire is reduced by over 1,000 acres when compared with the existing condition. Following treatments, stands would move from a Fire Regime Condition Class of 3, toward a Fire Regime Condition Class of 1 and 2, reducing the acreage of Ponderosa Pine Forest that is currently extremely departed from the natural range of variability. The acres of non-lethal fire are expected to increase, suggesting the stands move closer toward their historic fire regime of frequent, low-severity wildfire. Under a moderated fire regime, potential high mortality resulting from an unplanned ignition would be reduced.

Under the proposed action alternative, states containing Old Growth increase to 1,689 acres (11.5 percent of total ecological response unit) over the next 20 years, primarily transitioning from medium-size tree states stemming from tree growth and treatments (Table 3-12). This increase primarily goes to the two open states 1,233 acres (73 percent). These are much more resistant to loss from crown fire and threats from insects, primarily bark beetles, and are expected to be more sustainable over time.

Use of Fire

Prescribed fire (broadcast burning and pile burning) would be used to treat 13,114 acres of the Ponderosa Pine Forest ecological response unit, typically following vegetation thinning treatments. All forms of prescribed fire treatment may be applied. Prescribed fire prescriptions would be established so that fire intensity is carefully managed in order to meet desired conditions characteristic of a low-severity fire regime. Low-intensity prescribed fire would be used to treat all seral stages in the ecological response unit; moderate-intensity prescribed fire would be used to treat only acres currently classified as medium large closed, in order to increase tree mortality so residual stands meet more open and patchy desired conditions (U.S. Forest Service 2018a).

Broadcast burning, particularly under moderate intensities as proposed under this alternative, can be effective at controlling dwarf mistletoe infestations that have been prevalent in ponderosa pine in the project area; the effectiveness of the treatment depends on whether infected trees are scorched or killed to prevent mistletoe spread (Harrington and Hawksworth 1990).

Broadcast burning could result in the loss of individuals and communities of plants for up to two growing seasons post-fire. Ponderosa pine is a fire-adapted/resistant species due to its thick bark, deep roots, and relatively high and open growth habit (Allen and others 2002) and ponderosa pine seedling establishment is favored when fire removes forest floor litter (Kane and other 2010). Therefore, a ponderosa pine community would recover relatively quickly from prescribed burns. In the long term, the Ponderosa Pine Forest vegetation community would benefit from prescribed fire, since the understory would be thinned, litter converted to nutrients, and initial steps taken to reestablish a natural fire regime.

Following broadcast burning, Gambel oak may occupy the post-fire successional stage within the stand and may persist for several decades (Brady and Bonham 1976; Hanks and Dick-Peddie 1974). If Gambel oak is prolific in the understory, follow-up treatment may be necessary in order to encourage ponderosa pine regeneration (Tirmenstein 1988). Typical plant succession in ponderosa pine forests begins with colonization of grasses and forbs, and commonly Gambel oak regenerates from root sprouts. Depending on seed sources, ponderosa pine seedlings generally colonize herbaceous areas and/or among Gambel oak patches, to eventually dominate the vegetation. Ponderosa Pine Forests are typically fire adapted and maintained by frequent, low-severity surface fires that regenerate herbaceous vegetation, and kill most ponderosa pine saplings, but do not kill larger trees. Repeated broadcast burning, using monitoring and adaptive management concepts, is the recommended management tool to maintain ponderosa pine forests and woodlands in their historic climax seral stage.

The removal of residual fuels following thinning treatments would reduce hazardous fuel loading and by emulating wildfire, broadcast burning would help the Lincoln National Forest move closer to the goal of promoting the role of fire in these fire-adapted ponderosa pine forests. The continued application of broadcast burning would result in long-term (decades) benefits as a more open overstory and a perennial herbaceous understory would develop on most sites, bringing stands closer to desired conditions for the Ponderosa Pine Forest vegetation community. Over time, more pronounced increases in species richness, diversity, and resiliency would occur with a tendency toward fire-tolerant plant species across the affected landscape. Fire regimes would be reduced to a lower condition class across the ecological response unit, providing long-term (decades) beneficial impacts on stand resiliency to uncharacteristic wildfire.

Adaptive management would be applied throughout the life of the project to ensure that treatments are moving ponderosa pine forests closer to desired conditions. Periodic monitoring would be applied throughout the project area, and monitoring results would be documented and reviewed to determine whether adjustments in design features should be made to maintain or improve resource conditions.

Pinyon-Juniper Communities

Affected Environment/Existing Conditions

Pinyon-juniper vegetation communities generally occur at elevations between approximately 4,500 and 7,500 feet. They are dominated by one or more species of pinyon pine and/or juniper. In the South Sacramento Restoration planning area, pinyon-juniper communities can occur with a grass/forb-dominated understory (Pinyon Juniper Grass) or a discontinuous understory of some grasses and/or shrubs (Pinyon Juniper Woodland). For the purpose of this analysis, the Pinyon Juniper Woodland and Pinyon Juniper Grass (that make up 18,998 and 222 acres, respectively) are combined into one analysis.

Mixtures of pinyon pine (*Pinus edulis*) and oneseed juniper (*Juniperus monosperma*) occur on xeric, lower-elevation sites; pinyon and alligator juniper (*Juniperus deppeana*) occur at higher elevations up to about 7,000 feet and on more mesic sites or those with deeper soils. Most pinyon-juniper associations have grassy understories, which have been much depleted by overgrazing (Kaufmann and others 1998).

Species composition and stand structure of the pinyon-juniper communities vary by location primarily due to precipitation, elevation, temperature, and soil type. Dick-Peddie (1993) provides detailed descriptions of the plant species compositions, the seral stages of ecological succession, and the processes causing succession for the Pinyon Juniper ecological response unit under Pinyon Juniper Woodland.

Pinyon Juniper ecological response unit vulnerability to climate-induced environmental stress across the Lincoln National Forest (percent of total unit landscape) over the next 20 years is: Low Vulnerability 0 percent, Moderate Vulnerability 34 percent, High Vulnerability 53 percent, and Very High Vulnerability 12 percent (see Figure 3-4) (U.S. Forest Service 2017c).

According to studies in the area, Pinyon Juniper Woodland has become much more dense than the historic conditions described by General Land Office survey notes from the early 1900s, and most of the pinyon trees are relatively young (Kaufmann and others 1998). Many of them are probably regeneration following the severe Ips engraver beetle outbreak early in the twentieth century (Kaufmann and others 1998).

Studies suggest that past fire regimes in southwestern Pinyon Juniper Woodlands were mixed, with both surface and crown fires occurring and exhibiting variable intensity and frequency, depending on the productivity of the site: “Productive sites could sustain patchy fires at intervals of 10 to 50 years, and could have attained densities sufficient to carry crown fires at intervals of 200 to 300 years. In open stands, where grass cover was continuous, fire intervals might have been 10 years or less, and probably maintained grasslands and savannas” (Gottfried 1999:107).

Fire-scar studies completed in the Sacramento Mountains record fire scars on pinyon pines at low elevations, with a mean fire interval of 28 years, over 14 intervals (Huckaby and Brown 1995; Wilkinson 1997). Wilkinson (1997) found that fires were more frequent at low elevations, and that fire scars on pinyon pines indicate that not all fires in Pinyon Juniper Woodland are stand-replacing crown fires, as has been thought. Fires occurring at lower elevations appear to have been localized; however, some fire dates from higher elevations also coincided with fire dates at lower elevations (Kaufmann and others 1998).

Abundant oak brush covers 70 percent to 90 percent of the understory of many pinyon-juniper stands and fills openings in the woodlands (Kaufmann and others 1998). General Land Office survey notes from the 1880s indicate that dense oak brush and vigorous grass cover occurred under a more open Pinyon Juniper Woodland (Kaufmann and others 1998).

The majority of the ecological response unit is classified as sapling small open seral state (Table 3-12 and Figure 3-21); this is a state where trees are generally less than 10 inches in diameter and smaller, with tree canopy cover less than 30 percent. The existing conditions of the stands are therefore a predominance of young to mid-aged woodlands, with moderate numbers of trees per acre, medium basal areas, and low canopy cover. Crowning index is high, meaning that crown fire would only be initiated with high winds over 90 miles per hour. Currently 3,465 acres (21 percent) are in the medium large seral states, states containing Old Growth components. For the woodland Ecosystem Response Units, medium and large tree states are not split other than open and closed.

Table 3-12. Pinyon-Juniper Indicators, Existing Condition

Pinyon-Juniper Communities Seral Stage	Acres	Vegetative Structural Stage	Trees per Acre	Basal Area	Canopy Cover (%)	Crown Base Height (feet)	Fuel Loading (tons/acre)	Crowning Index (miles/hour)	Torching Index (miles/hour)	Fire Regime Condition Class
Medium Large Closed	2,378	5	271	120	41	8.1	11.5	67	11	3
Medium Large Open	1,087	5	162	69	22	8.2	6.6	149	11	1
Small Closed	2,396	3	430	106	44	6.5	11.2	57	6	3
Sapling-Small Open	10,782	3	307	44	22	6.1	4.0	90	5	1
Grass/Brush	28	1	75	13	6	5.6	3.4	170	7	1
Total	**16,671**									

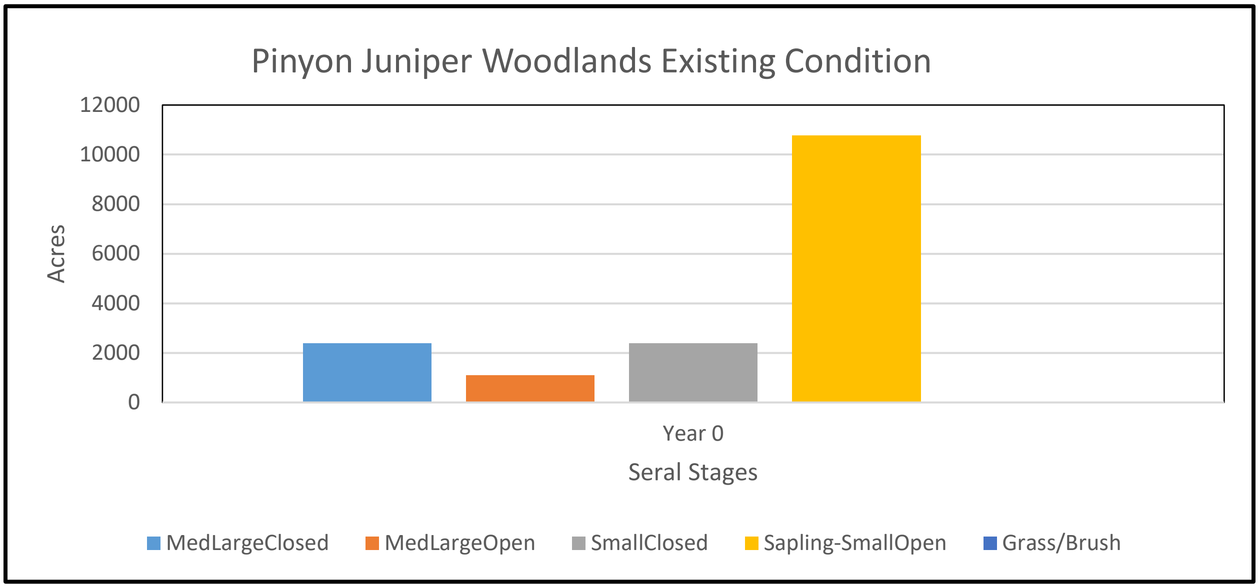

Figure 3-21. Composition of seral states for existing pinyon-juniper-oak communities within the South Sacramento Restoration Project Area.

<u>Environmental Consequences</u>

The effects of implementing the no action alternative and the proposed action on pinyon-juniper communities are presented below in Table 3-13 and Figure 3-22. Impacts common to all alternatives are described above. Specific impacts to the pinyon-juniper communities' ecological response unit are described below.

The no action alternative and proposed action are presented in the same table and graphs for comparison. As the reader moves down the rows in Table 3-13 for the different seral states that make up the Pinyon-Juniper community ecological response unit, the associated stand structure for that seral state (i.e., vegetation structural state, trees per acre, basal area, etc.) changes. The first column in the table shows the acreages within each seral state at year 0 (the existing condition). Column two shows how after 20 years of no action, the acres within each seral state would be distributed. Column three shows how after 20 years of the proposed action, the acreages in each state shift, with fewer acres within the sapling small open seral state and those acres instead distributed with increased acreages within the medium large open state, and increased acreages of grass/brush (see Figure 3-22). Generally, this means that the proposed action would result in more mature woodland stands with larger trees and more open grassland between clumps.

The remaining columns in Table 3-13 describe the stand structure characteristics for each state, which do not vary by alternative. The graph (see Figure 3-22) shows the redistribution of acres of pinyon-juniper communities between each state under the no action and proposed action, relative to the existing condition.

Table 3-13. Indicators for the Pinyon-Juniper Communities' Ecological Response Unit under the No Action Alternative and Proposed Action, Relative to the Existing Condition

Pinyon-Juniper Communities Seral Stage	Acres Year 0	Acres No Action Year 20	Acres Proposed Action Year 20	Vegetative Structural Stage	Trees per Acre	Basal Area	Canopy Cover (%)	Crown Base Height (feet)	Fuel Loading (tons/acre)	Crowning Index (miles/hour)	Torching Index (miles/hour)	Fire Regime Condition Class
Medium Large Closed	2,378	5,830	2,249	5	271	120	41	8.1	11.5	67	11	3
Medium Large Open	1,087	2,580	8,220	5	162	69	22	8.2	6.6	149	11	1
Small Closed	2,396	4,521	1,287	3	430	106	44	6.5	11.2	57	6	3
Sapling-Small Open	10,782	3,542	2,896	3	307	44	22	6.1	4.0	90	5	1
Grass/Brush	28	198	2,019	1	75	13	6	5.6	3.4	170	7	1
Total	**16,671**	**16,671**	**16,671**									

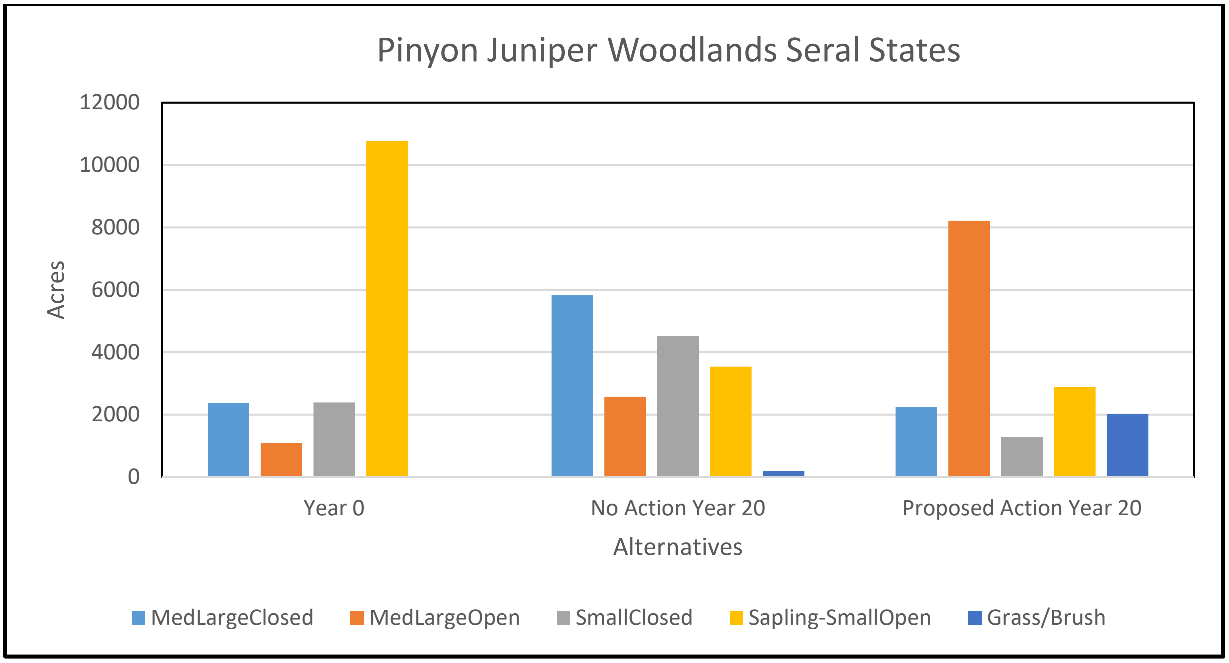

Figure 3-22. Composition of seral states for Pinyon-Juniper communities' ecological response unit within the South Sacramento Restoration Project Area under the no action and proposed action, relative to the existing condition.

Alternative A – No Action

Under the no action alternative, the proposed forest restoration activities would not occur within the project area. Therefore, no long-term beneficial impacts to pinyon-juniper vegetation and fire and fuels would occur.

Pinyon Juniper Woodland stand dynamics are driven largely by climate (Clifford and others 2008; Shaw and others 2005; West and Van Pelt 1987). As a result, future projected climate change, especially prolonged periods of drought (Hoerling and Kumar 2003), are expected to heavily influence the range and composition of the pinyon-juniper community in the project area. After 20 years of no action, the project area is projected to see an increase in the acreage of medium large closed seral state and small closed states, and a reduction in sapling small open seral states. This is characteristic of Pinyon Juniper Woodland communities in the region, where pinyon-juniper has increased in range and density, usually transgressing into adjacent grassland (Pieper 2008). Grassland encroachment has been attributed to periods of drought, overgrazing, fire exclusion, and climate change (Romme and other 2009).

Under the no action alternative, states containing Old Growth increase to 8,410 acres (51 percent of the ecological response unit) over the next 20 years, primarily due to transition from medium-size tree states stemming from tree growth (see Table 3-14). Most of this increase (80 percent) is in the closed state, the least-resistant state to crown fire and insect threats.

Interactions between drought and insect infestation have been found to influence mortality in the pinyon-juniper vegetation community. Incidences of pinyon *Ips* bark beetle (*Ips confuses*) infestations have been linked to stands severely affected by water stress (Wilson and Tkacz 1992); infestations have resulted in high levels of mortality of pinyon pine throughout the region (Pieper 2008). Stand density and increased competition has been argued to be a large factor predisposing stands to drought and insect-caused mortality (Floyd and others 2009). The pinyon ips bark beetle generally attacks stressed or dying trees (Kylo 2016). With an absence of treatments, pinyon-juniper stands would continue to expand and increase in density making the ecological response unit more susceptible to competition for resources, low individual tree vigor, and more vulnerable to attack by the pinyon ips and other forest insects and pathogens (Raffa and others 2008) as projected in Figure 3-23. The long-term persistence of pinyon pine, which is more sensitive than juniper species to increased temperature, may be severely affected by climate change, experiencing a large reduction in distribution by the end of the century, even disappearing altogether from many areas where it occurs now (Pieper 2008). Drought conditions and insect and disease outbreaks would result in long-term decline in woodland health in the project area, as the long-term sustainability of the vegetation community is threatened.

Research has shown that as total canopy cover increases in pinyon-juniper communities, total understory biomass decreases (Huffman and others 2017; Pieper 1992), therefore denser stands predicted under the no action are expected to support fewer understory herbaceous communities, impacting wildlife species habitat and species composition and diversity within the ecological response unit. Juniper trees have shallow roots that spread through the soil broadly around each tree far beyond the canopy drip-lines. Those tree roots compete for soil water and nutrients directly with the roots of herbaceous vegetation, often creating rings of bare soil beyond the duff layers under the trees. Blue grama (*Bouteloua gracilis*) and other perennial grass species are dominant plants of the pinyon-juniper stand understories, and they tend to colonize soils where trees have died or have been removed. Thinning pinyon and juniper has a strong effect of increasing the cover and production of understory herbaceous plants. Various annual and perennial forbs colonize soils during the early seral stages of succession, followed by perennial grasses and forbs in mid-seral stages, and eventually pinyon and juniper trees become established in later seral stages. Wildfire is a disturbance that impacts both pinyon and juniper trees, while pinyon ips bark beetles may kill most of the pinyon trees, but leave junipers, resulting in a transition to juniper savanna. In addition, pinyon is more sensitive to fire than alligator juniper and often grows from within a nurse shrub or tree, making it more susceptible to ladder fuels, whereas large alligator juniper has thick bark and can sprout from branches if scorched, or from root collar if top-killed.

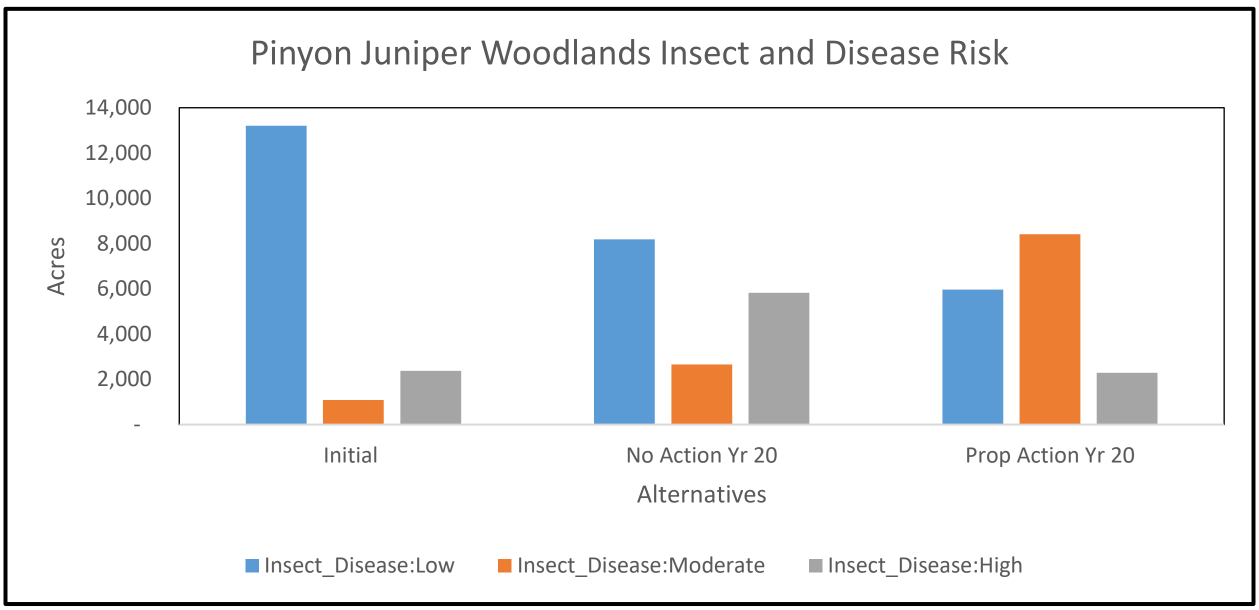

Figure 3-23. Modeled insect and disease ratings for the Pinyon-Juniper communities ecological response unit under each alternative, compared with existing conditions.

Table 3-14. Pinyon-Juniper Woodland Medium and Large Tree States: Current Conditions, No Action, and Proposed Action

Pinyon-Juniper Woodland	Current Condition	No Action at 20 years	Proposed Action at 20 years
Closed	2,378	5,825	2,290
Open	1,087	2,656	8,417
Total	**3,465**	**8,481**	**10,707**

As herbaceous communities diminish with increased canopy cover, fine fuels are also reduced particularly during drought years (Romme and others 2003). Although a reduction in fine fuels reduces potential for surface fire transmission, as canopies begin to close, woody debris accumulation under canopies can contribute to heavier fuel loading which increases overall fire risk (Romme and others 2003) as shown in Figure 3-24, which shows an increase in potential mixed-severity impacts, including some overstory mortality and stand replacement. Large-scale, stand-replacing fires are rare in this vegetation community because they require dense and mature woodlands (Margolis 2014) but where there is a continuity and abundance of canopy fuels, the community can support fire spread from tree to tree (Romme and others 2009). Over many decades, continued canopy closure may support high-intensity stand-replacing fires which are more difficult to suppress and pose increased risks to life and property if they occur within the wildland-urban interface. Adverse impacts resulting from increased wildfire risk and fire-induced mortality under the no action, would be long lasting (decades to centuries), due to the slow growth of pinyon-juniper woodlands, and the potential interaction of climate change on the long-term sustainability of the vegetation community.

The lack of treatments would result in short-term (one to two growing seasons) and long-term (decades) adverse impacts because the benefits that would come from restoration treatments in pinyon-juniper communities would not be realized.

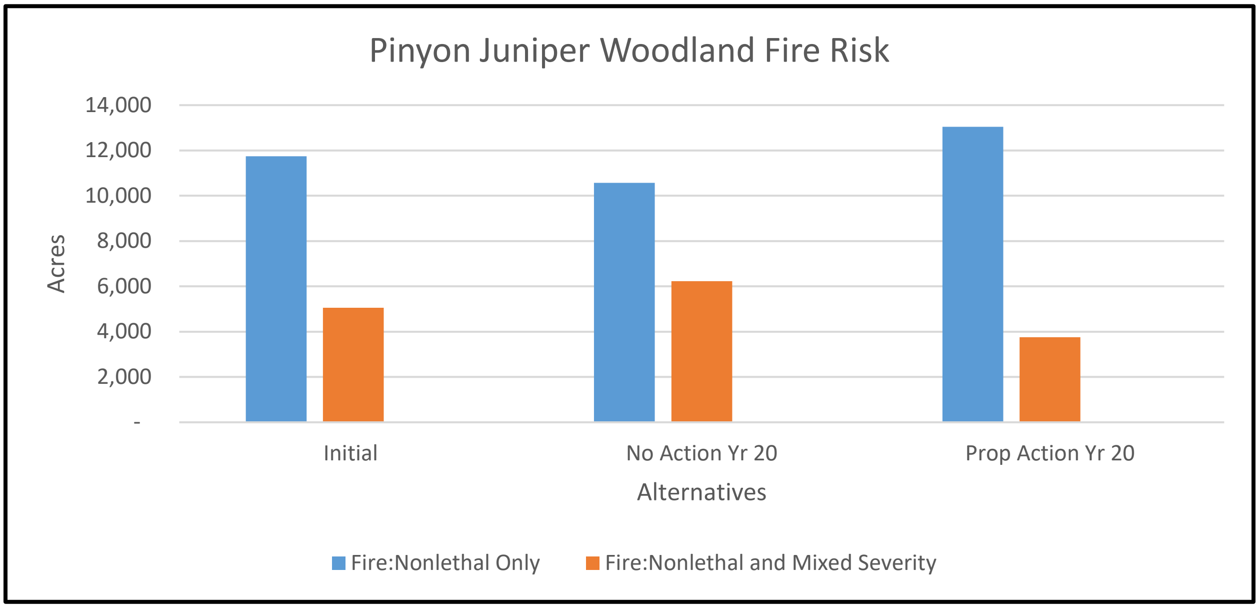

Figure 3-24. Modeled fire risk to Pinyon-Juniper communities ecological response unit under each alternative, compared with the existing conditions.

Alternative B – Proposed Action

Vegetation Thinning

Under the proposed action, silvicultural treatments would impact 9,760 acres of the Pinyon Juniper Woodland ecological response unit and 48 acres of the Pinyon Juniper Grass. Group selection would be used to complete all thinning treatments in the woodland communities, while free thinning would be used to treat Pinyon-Juniper Grass communities. After 20 years of treatments the composition of seral states within the ecological response unit show an increase in acres within the medium large open seral stage, with an accompanying decrease in the small sapling stage. Stands would shift from a predominance of Vegetative Structural Stage 3, to a Vegetative Structural Stage 5, with almost half the trees per acre of the existing condition and reduced basal areas and stand densities. Percent canopy covers would not change significantly, but crown base heights would increase with an associated increase in crowning index from 90 miles per hour, to 149 miles per hour. Stand-replacing fires would not be a component of the fire regime under these conditions.

Under the proposed action, there would be a 61 percent decrease in acres vulnerable to high incidence of insect and disease, compared with the no action alternative. Reduced stand densities and reduced competition would result in improved tree vigor which makes stands more resilient to insect and disease infestations; treatments therefore provide short- and long-term beneficial impacts for woodland health.

Under the proposed action, there would be a 40 percent reduction in the risk of mixed-severity fire, compared with the no action alternative. Fuel loading is low under all alternatives with less than 11 tons per acre (the threshold beyond which fuel loads would be considered heavy in this vegetation community [Paysen and others 2000]). As states are moved from small sapling–dominated to more mature medium large open stages, the fuel loading increases slightly due to contributions to the surface fuel loads from woody overstories and snags. Conversely as states mature and become widely spaced with larger canopies, there is a reduction in the cover of herbaceous fuels which are needed to sustain surface fires. Due to insufficient canopy closure to promote fire spread between trees and insufficient dead woody fuels on the surface and as standing snags, it is unlikely that the key conditions for crown fires would be met under the proposed action (except maybe under extreme weather conditions) (Gottfried and others 1995). As stands are treated under the proposed action, fire risk is reduced both in the short term (less than 2 years) and long term (greater than 2 years). The degree of departure from historic conditions would decrease as states are moved from a Fire Regime Condition Class of 3 to Fire Regime Condition Classes of 2 and 1, helping the Forest Service move states closer to desired conditions that are more resilient to high-severity wildfire hazard.

Under the proposed action alternative, states containing Old Growth increase to 10,707 acres (64 percent of total ecological response unit) over the next 20 years, primarily transitioning from young size tree states stemming from tree growth and treatments (see Table 3-14. This increase primarily goes to the open state 8,417 acres (79 percent). These are much more resistant to loss from crown fire and threats from insects, primarily bark beetles, and are expected to be more sustainable over time.

Use of Fire

Prescribed fire (broadcast burning and pile burning) would be used to treat 13,921 acres of the Pinyon Juniper Woodland ecological response unit. All forms of prescribed fire treatment may be applied. Prescribed fire prescriptions would be established so that fire intensity is carefully managed in order to meet desired conditions. Low-intensity prescribed fire would be used to treat 10,666 acres of medium large open, sapling-small open and grass and brush seral stages, while moderate-intensity prescribed fire would be applied to 3,255 acres of medium large closed and small closed stages in order to open the canopy and favor more open seral stages.

One seed juniper is more susceptible to fire than pinyon pine (Rundel and Yoder 1998), with the greatest mortality associated with young trees less than 4 feet tall (Paysen and others 2000) and very hot fires during a period of drought (Jameson 1961). There is less impact on older, larger trees that have thicker bark and higher crown base heights that exceed flame lengths (Johnson 2002). Prescribed burns under the proposed action would be applied primarily under low-intensity conditions, for example fast-moving surface fires that would be unlikely to cause long-lasting impacts to desirable medium and mature trees and would be successful in promoting larger more mature trees and more open stand conditions.

A low-intensity fire would help increase the size and age class diversity of the woodland vegetation type. Frequent fire has been shown to promote and maintain juniper grasslands (Mueggler 1976), so prescribed fire frequency would determine the long-term (decades to centuries) structure and composition of the ecological response unit. More intense burns within the small closed canopy seral stages are expected to result in high levels of mortality if the surface fuel loading is high enough to generate the appropriate fire intensity to top-kill trees (Wittie and McDaniel 1998). Adaptive management would be applied based on monitoring results to ensure prescriptions are resulting in desired effects. The trees per acre figures and average tree heights in the ecological response unit meet thresholds found to be susceptible to control treatments (Arnold and others 1964) so target mortalities are likely to be met. Treatments would therefore be successful in meeting desired conditions.

Pinyon-juniper stands have slow succession rates. A number of factors can influence the pattern of succession after fire, including past use history, site factors, moisture regime, stand age when disturbed, fire severity, presence of residual trees, and the presence of animal dispersal agents (Bradley and others 1991). The successional recovery of pinyon-juniper after a fire begins with the establishment of annuals, followed by a perennial grass stage, a shrub stage, and then the establishment of trees that lead to the pinyon-juniper climax. As pinyon-juniper crown cover increases, cover, productivity, and density of understory species decrease. Fire opens pinyon-juniper stands, increases diversity and productivity in understory species, and creates a mosaic of stands of different sizes and ages across the landscape (Keeley 1981).

Prescribed burning may impact future regeneration of the stand if frequencies of treatment do not allow establishment of some smaller trees (Paysen and others 2000). In the unlikely event that a prescribed fire results in high mortality of mature trees, post-fire reestablishment of oneseed juniper is primarily through seed and is relatively slow, therefore recovery may take several years to decades depending on site conditions (Johnsen 1959). The use of resource protection measures, including careful consideration of appropriate prescribed fire prescriptions, season of burn, and fuel moisture conditions, would reduce the potential for any long-lasting adverse impacts.

Wildfire in pinyon-juniper is relatively rare and infrequent; fire spread is heavily influenced by surface fuels and fuel loading, as well as canopy closure. Under the proposed action, the higher fuel loadings associated with small closed and medium-large seral stages, are mitigated as states are opened up; with lower fuel loadings and scant herbaceous fuels, wildfire ignitions are unlikely to be sustained (Keeley 1981) and if they do occur, they would remain as surface spread and not transition to crown fire. Prescribed fire can be used to reintroduce fire to these stands at a low intensity, providing for maintenance of the open state with minimal overstory mortality. Conversely the prescription under which fire is applied would be altered in closed canopy areas, where greater mortality is desired to open up the stand. Prescribed fire would help the Lincoln National Forest meet desired conditions for both Pinyon Juniper Woodlands and Pinyon Juniper Grass, improving woodland structure and composition for long-term sustainability.

The combination of repeated burning and thinning provides long-term benefits due to the reduction of crown-bulk density, which influences potential crowning fire behavior and fire helps stimulate new growth of the herbaceous understory, including grasses and low shrubs. Pile burning would be applied to address slash piles in fall, winter, and early spring when favorable conditions are present. Strict prescriptions would be applied to mitigate any adverse impacts to soils and future growing conditions resulting from pile burning.

Herbicide Application

Herbicide application would be used to treat juniper and oak sprouts following treatments. The effectiveness of the treatment on the control of alligator juniper sprouts is thought to be dependent on range site, tree growth characteristics, and the rate of herbicide application (McDaniel and others 1989; Wittie and McDaniel 1988). Often two or more control methods need to be applied to successfully control encroachment (Wittie and McDaniel 1988), for example herbicide application followed by prescribed fire. Treatments to reduce encroachment therefore would require long-term maintenance (every 2 to 3 years over the life of the project) and adaptive management to be successful in the long term.

Foliar application of herbicide to juniper sprouts could impact non-target species as a result of herbicide drift. Potential adverse impacts to non-target species would be minimized by following herbicide application directions and adhering to resource protection measures.

Following treatments, understory herbaceous species production would increase as canopy shading is reduced (Wittie and McDaniel 1988). Grass and herbaceous cover would respond one to two growing seasons after treatment, creating short-term benefits to vegetation composition and species diversity. If canopy levels are successfully maintained through continued treatment, herbaceous production would remain high over the life of the project. Adaptive management would be applied throughout the life of the project to ensure that treatments are moving pinyon-juniper communities closer to desired conditions. Periodic monitoring would be applied throughout the project area, and monitoring results would be documented and reviewed to determine whether adjustments in design features should be made to maintain or improve resource conditions.

Gambel Oak Shrubland

Affected Environment/Existing Conditions

Gambel Oak Shrubland is dominated by long-lived Gambel oak clones that form largely monotypic overstories (Simonin 2000) and generally occurs between 6,500 and 9,500 feet on all aspects, although at higher elevations it occurs more predominantly on southern exposures. Gambel oak occurs as the dominant species, ranging from dense thickets to clumps associated with other shrub species. Older, more developed Gambel oak can have a well-developed understory comprising snowberry, yarrow (*Achillea millefolium*), and goldenrod (*Solidago*). Depending on site potential, ponderosa pine, juniper, and pinyon pine can encroach on older plant communities. The primary disturbance mechanism is mixed-severity to stand-replacing fire resulting in top-kill and rare mortality. Gambel oak responds to fire with vigorous sprouting from the root crown. Large forms may survive low-intensity surface fire. Dick-Peddie (1993) provides detailed descriptions of the plant species compositions, the seral stages of ecological succession, and the processes causing succession for the Mixed Conifer with Aspen ecological response unit under Douglas-fir-Gambel Oak, Ponderosa Pine-Gambel Oak, and Ponderosa Pine-Pinyon Pine-Gambel Oak Series. Gambel oak stands largely represent early seral stages in the succession of ponderosa pine and pinyon-juniper woodlands, but may persist for decades.

Environmental Consequences

Resource indicator measures for the Gambel Oak Shrubland ecological response unit are not included in this analysis since the measures pertain to forested and woodland vegetation only. Impacts common to all alternatives are described above. Specific impacts to the Gambel Oak Shrubland ecological response unit are described below.

Wildfire risk is modeled under all alternatives in Figure 3-25.

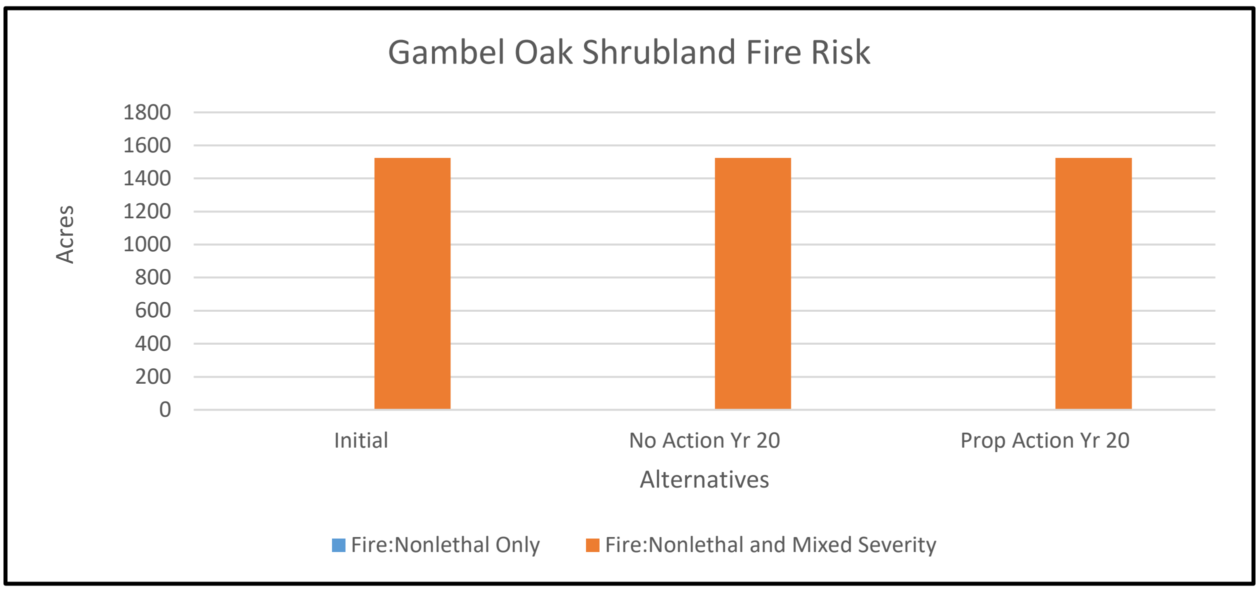

Figure 3-25. Modeled fire risk to Gambel Oak Shrubland ecological response unit under each alternative, compared with the existing conditions.

Alternative A – No Action

Under the no action alternative, the proposed forest restoration activities would not occur within the project area. Therefore, no long-term beneficial impacts to Gambel oak vegetation communities and fire and fuels within the Gambel Oak ecological response unit would occur.

Fire is a primary driver of the Gambel Oak Shrubland ecological response unit. Under the no action alternative, no treatments would occur in the Gambel Oak Shrubland ecological response unit. The species thrives with disturbance, prolifically resprouting following fire, grazing, or other disturbances (Abella 2008). With an absence of disturbance the community continues to mature, with some tree-like diameters; in some instances the community may be seral to adjacent ponderosa pine and mixed conifer communities, and would be reduced in the understory as the conifer component becomes dominant (Abella 2008). As Gambel Oak Shrublands mature into young poles, any fires occurring in the stand would be intense and stand replacing, creating openings within the community that are either colonized by resprouts, or return the stand temporarily into a grass-forb stage (Crane 1982). Stands typically mature in 60 to 80 years, at which point, in the absence of fire, mature oak stems die naturally creating more openings for sprouts (Crane 1982).

Gambel Oak Shrubland has a non-lethal mixed-severity fire risk under all alternatives according to integrated landscape assessment project modelling (see Figure 3-25), suggesting continued persistence of the species under even a no action alternative. Due to the intense fire regime of Gambel Oak Shrublands, however, especially as stands mature, a wildfire ignition under these stand conditions could pose a threat to adjacent vegetation communities or community values at risk within the wildland-urban interface. Intense fire behavior is difficult to suppress and may exceed suppression resources, limiting potential containment. Although adverse impacts on the Gambel Oak Shrubland community would be short term, the potential impacts of an intense stand-replacing fire on adjacent ecological response units, for example Mixed Conifer-Frequent Fire and Ponderosa Pine, would be adverse and long term.

Species composition in the understory is dependent on the density of the overstory community, with greater richness below more mature larger stems that allow more light infiltration to the ground surface, but more varied growth forms, including thick oak thickets, provide a richer habitat for wildlife, including large volumes of mast. Without disturbance the diversity of growth forms, vigorous resprouts and maintenance of shrubland structure would be threatened (Abella 2008).

Lack of treatment with herbicides would result in short-term (one to two growing seasons) and long-term (decades) changes to the Gambel oak vegetation community as the community matures and becomes vulnerable to stand-replacing wildfire and/or succession to overstory seral species.

Alternative B – Proposed Action

Vegetation Thinning Treatments

No vegetation thinning treatments are planned within the Gambel Oak Shrubland ecological response unit. Therefore, there would be no impacts to Gambel Oak Shrublands from mechanical treatments under the proposed action.

Use of Fire

Prescribed fire would be used to treat 2,400 acres (including multiple entries) of the Gambel Oak Shrubland ecological response unit. All forms of prescribed fire treatments may be applied. Gambel oak is a fire-adapted species that would respond prolifically to disturbance from prescribed fire (Vankat 2013). Top-kill of Gambel oak promotes vegetative sprouting from the lignotuber and rhizomes (Simonin 2000) even as early as 10 days post-fire (Tiedemann and others 1987). The rate of post-fire recovery of Gambel oak is dependent on site conditions, fire severity, and climatic factors, with recovery occurring at the greatest rate on warm, south-facing sites at lower elevations (Kunzler and Harper 1980). Larger tree forms of oak may survive low-severity prescribed fire (Harper and others 1985). Depending on the intensity of prescribed fire applied, some fire may promote a brief grass-forb stage that may be maintained by frequent re-entry with prescribed fire (Brown 1958). Monitoring would be used to determine whether prescriptions are meeting desired effects, and adaptive management would be applied as needed.

Gambel Oak Shrubland has a non-lethal mixed-severity fire risk under all alternatives according to integrated landscape assessment project modelling (see Figure 3-25), suggesting continued persistence of the species under even a no action alternative. Gambel oak has an inherent advantage over other species following fire and other disturbances. It may occupy a post-fire seral stage in many other ecological response units within the project area following thinning treatments, prescribed fire or wildfire. According to studies, post-fire regrowth of Gambel oak is greatest the first year following fire and the species dominates for approximately 25 years post-fire, and may persist for up to 100 years before canopy suppression by overstory species (Erdman 1969; Kunzler and Harper 1980). The use of prescribed fire to control the dominance of Gambel oak would only provide short-term effects, with most disturbance resulting in the growth of Gambel oak thickets in the first growing season post fire (Brown 1958; Long 1941). Fall burning has minimal impacts on Gambel oak dominance, the greatest control on Gambel oak occurs when burning is initiated when carbohydrate reserves within the plant are at their lowest, typically during the summer months (Marquiss 1969). The species is most severely harmed by successive fires when carbohydrate reserves are low (Marquiss 1969; Tirmenstein 1988). Control of the species therefore depends on the timing of the prescribed fire and the frequency of burning. Prescribed fire can be used to perpetuate the vegetation community, with repeat disturbance resulting in long-term dominance of Gambel oak, preventing succession to other overstory species.

Herbicide Application

Herbicide application would be used to treat resprouting of Gambel oak within the ecological response unit and Gambel oak sprouting following treatments in other ecological response units in the project area. The effectiveness of herbicide treatments in controlling resprouting is dependent upon the application methods and season of application (Marquiss 1973). The best control has been found when treatments and herbicides are applied during periods of low carbohydrate reserves (Berg and Plumb 1972), which occurs during the summer months.

Long-term control of Gambel oak is difficult to achieve because of the species' large underground structure which supports rapid and extensive sprouting following top removal (Marquiss 1973). Therefore, management of Gambel oak in the project area is likely to only be successful if treatments are continuously applied. Some herbicide treatments may be effective at removing Gambel oak but may also kill desirable native species. The most effective control has been reported with the use of picloram mixtures (Marquiss 1973); however, most studies suggest that integrated management, using mechanical and herbicide treatment, is needed for control, with optimal success observed with high application rates and higher treatment costs (Vallentine and Schwendiman 1973).

The application of herbicide to Gambel oak sprouts could impact non-target species as a result of herbicide drift. Potential adverse impacts to non-target species would be minimized by following herbicide application directions and adhering to resource protection measures. Adaptive management would be applied throughout the life of the project to ensure that treatments are moving Gambel oak shrubland closer to desired conditions. Periodic monitoring would be applied throughout the project area, and monitoring results would be documented and reviewed to determine whether adjustments in design features should be made to maintain or improve resource conditions.

Mountain Mahogany/Mixed Shrubland

Affected Environment/Existing Conditions

Mountain Mahogany Mixed Shrubland vegetation generally occurs in foothills, canyon slopes, and lower mountain slopes. These shrublands are often associated with exposed sites, rocky substrates, dry conditions, and recurrent historic fire that limited tree growth. Scattered trees or inclusions of grassland patches may be present, but sites are typically dominated by mountain mahogany (*Cercocarpus montanus*) and skunkbush sumac (*Rhus trilobata*). Dick-Peddie (1993) does not identify Mountain Mahogany Mixed Shrubland as a landscape-scale vegetation community, but describes the species assemblage as a minor component and often early seral stage of ponderosa pine and pinyon-juniper woodlands in some locations.

Mountain Mahogany Mixed Shrubland ecological response unit vulnerability to climate-induced environmental stress across the Lincoln National Forest (percent of total unit landscape) over the next 20 years is: Low Vulnerability 52 percent; Moderate Vulnerability 43 percent, High Vulnerability 7 percent, and Very High Vulnerability 0 percent (see Figure 3-4) (U.S. Forest Service 2017c).

The discontinuous nature of fine fuels in the ecological response unit means that historically the vegetation community would burn infrequently; the community is therefore characterized by a stand-replacing, infrequent (35 to 200 years) fire regime. If fires did occur they would burn with high severity. Mountain mahogany is typically top-killed by wildfire but can recolonize burned sites through root crown or rhizome sprouting (Cronquist and others 1997). If fire intensity is too high, however, seeds are killed and the presence of post-fire seedlings is often limited (Keeley and Keeley 1988; U.S. Forest Service 1997); under high-severity fires, mortality of the species is typically higher than under low-severity fires.

Due to a lack of fire over the past 100 years or more, the Mountain Mahogany Shrubland in the project area is currently in a tree-encroached state.

Environmental Consequences

Resource indicator measures for the Mountain Mahogany Mixed Shrubland ecological response unit are not included in this analysis since the measures pertain to forested and woodland vegetation only. Impacts common to all alternatives are described above. Specific impacts to the Mountain Mahogany Mixed Shrublands ecological response unit are described below.

Wildfire risk to the ecological response unit is modeled under all alternatives inFigure 3-26.

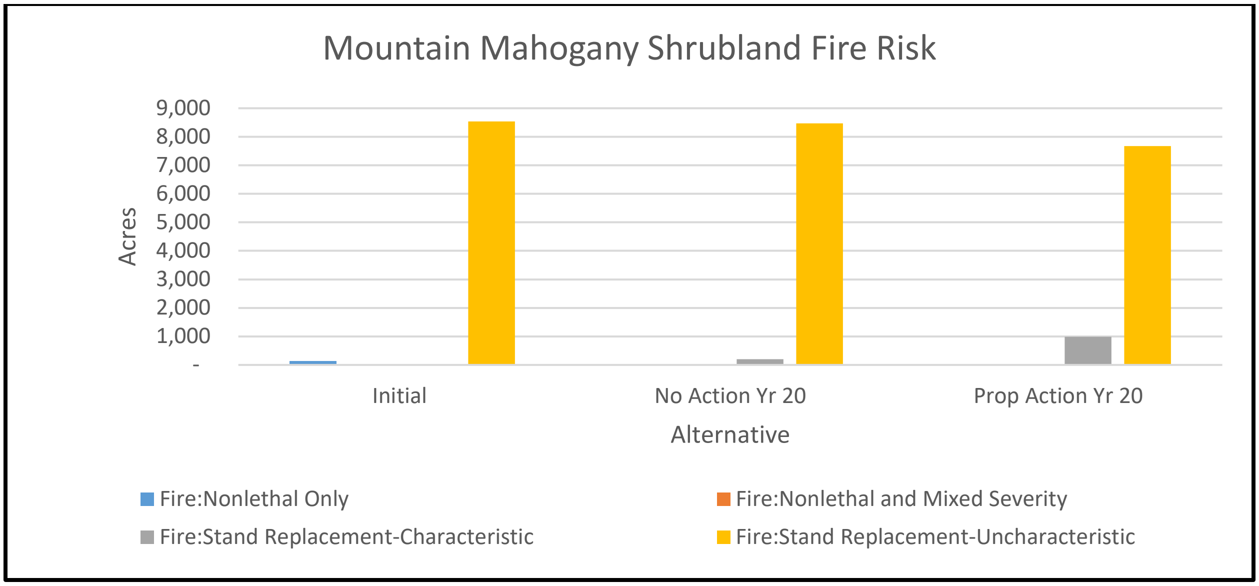

Figure 3-26. Mountain Mahogany Shrubland fire risk under all alternatives.

Alternative A – No Action

Under the no action alternative, the proposed forest restoration activities would not occur within the project area. Therefore, no long-term beneficial impacts to Mountain Mahogany Mixed Shrubland vegetation communities fire and fuels would occur. The Mountain Mahogany Mixed Shrublands represent early seral stages of pinyon-juniper or ponderosa pine woodlands, but may be persistent on exposed rocky slopes. This ecological response unit had the lowest vulnerability to climate change stress and is likely to remain largely intact or on a slow trajectory toward conifer woodland.

The existing tree-encroached state in the project area would continue, due to a lack of vegetation thinning treatments or disturbance from the use of fire. The shrub and open condition would not be achieved. The continued dominance of conifer and decadent shrubs would increase fuel loading. Therefore, when an unplanned ignition does occur, fire severity would be high and uncharacteristic (see Figure 3-26) and result in high mortality within the ecological response unit (U.S. Forest Service 1997).

Alternative B – Proposed Action

Vegetation Thinning Treatments

No vegetation thinning treatments are planned within the Mountain Mahogany Mixed Shrubland ecological response unit. Therefore, there would be no impacts to Mountain Mahogany Mixed Shrubland from mechanical treatments under the proposed action.

Use of Fire

Prescribed fire would be used to treat 10,196 acres (including areas treated more than once) of the Mountain Mahogany Mixed Shrubland ecological response unit. All forms of prescribed fire treatments may be applied.

The intensity of fire effects under the proposed action in the mountain mahogany and mixed shrubland community and the degree of post-fire sprouting is dependent on the prescription and the fuel loading of fine fuels during the burn as well as the fire severity, degree of soil heating, soil and duff moisture, and physiological stage of plant development (Mitchell 1984). Moderate-intensity fire would be used to treat most of the ecological response unit. This would help to combat tree encroachment to help move the ecological response unit back toward the open shrubland state.

If fire intensity is high, regeneration of mountain mahogany may be limited, especially if temperatures are high enough to kill seed, or the season of the burn limits the post-fire sprouting. If prescribed fire is applied frequently to mountain mahogany-dominated sites, the prevalence of the species can also decline (Cronquist and others 1997). Under these conditions, long-term (greater than 2 years) impacts to the ecological response unit would be adverse, with potential for invasion by nonnative species and slow recovery of mountain mahogany. Monitoring would be used to inform the development and adaptation of prescribed burn plans to ensure that the treatment results in the desired condition for each treatment unit. The individual treatment plans would dictate the degree of mortality desired and the prescription would be adjusted to meet desired conditions.

Under the proposed action the risk of uncharacteristic stand-replacement fire is mitigated slightly (see Figure 3-26.), moving the ecological response unit closer to its natural range of variability and helping to restore the historic fire regime. If an unplanned ignition occurs under the proposed action, the degree of adverse impacts to the vegetation community would be less, compared with the no action alternative.

Adaptive management would be applied throughout the life of the project to ensure that treatments are moving Mountain Mahogany Mixed Shrubland communities move closer to desired conditions. Periodic monitoring would be applied throughout the project area, and monitoring results would be documented and reviewed to determine whether adjustments in design features should be made to maintain or improve resource conditions.

Cumulative Effects

The area of consideration for cumulative effects of the action alternative is the Lincoln National Forest, Sacramento Ranger District. Most of the vegetation community and fire and fuel resource impact effects discussed would be expected to occur within this area. The effects analysis applies to all ecological response units. See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on vegetation communities, fire and fuels.

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 cumulative short-term adverse and long-term beneficial impacts on vegetation communities and fire and fuel resources. Short-term adverse impacts include temporary, localized removal or disturbance of vegetation as a result of vegetation thinning treatments, prescribed fire, and herbicide application, and potential for indirect adverse impacts, including temporary damage to soil substrates that impact growing conditions and increased vulnerability to nonnative species resulting from disturbance.

Other restoration activities would occur on adjacent public lands, including the Rio Peñasco Two Project, Jim Lewis Fuel Reduction Project, Two Goats Restoration Project, and Westside Watershed Restoration Project restoration treatments. These projects would increase ecosystem resilience in the Sacramento Mountains. Combined, these projects would treat up to approximately 94,000 acres over the next decade. Mechanical treatments and other restoration activities on the adjacent state lands and tribal lands would further increase long-term forest health. Restoration treatments are designed to move vegetation communities toward desired conditions, so most impacts to vegetation communities would be considered beneficial both in the short and long term. Restoration treatments improve species composition, increase stand heterogeneity both in terms of structure and age distribution, and improve forest health and resilience to insect, disease, and infestation by nonnative species.

Actions to restore native vegetation and reduce hazardous fuels within the project area and surrounding lands cumulatively influence potential fire behavior. Vegetation thinning treatments and use of fire help to reduce hazardous fuel loading, break up fuel continuity on a landscape scale, and return native vegetation communities to within a closer approximation of their natural range of variability. In the short term and long term, surface and canopy fuel loading is reduced. In the event that a wildfire ignition occurs under these mitigated fuel conditions, there is less potential for catastrophic wildfire and therefore less adverse short- and long-term impacts. All restoration treatments occurring within the analysis area (see Table 1-8) would act to cumulatively reduce wildfire hazard on a landscape scale. Cumulative reduction of high-severity wildfire would mitigate adverse impacts to native communities, including providing greater protections to native seed source, reducing nonnative species infestations, providing greater resilience to insect and disease risk, and promoting improved watershed function.

Permanent vegetation removal and disturbance as a result of treatments within the project area and road construction and staging would cumulatively impact native vegetation in the analysis area. These actions would contribute to potential spread of nonnative species from increased vehicular movement throughout the analysis area and increase the amount of impervious surface in the area. These impacts are expected to be mitigated on a project-by-project basis through the application of resource protection measures so it is not anticipated that cumulative adverse impacts would result from the implementation of the proposed action coupled with other restoration activities.

Domestic livestock grazing is authorized through Term Grazing Permits on most of the project area. The permitted livestock is almost all cattle and a very limited number of horses. No sheep grazing is permitted in the project area. Domestic livestock grazing directly results in the removal of native vegetation, primarily perennial grasses, and changing vegetation species compositions, trampling and exposure of soil surfaces, and the spread of nonnative plant species (Vavra and others 1994). Since livestock move freely across the allotment landscapes, they potentially consume herbaceous vegetation across all ecological response units. The cumulative adverse impacts of livestock are likely to occur in areas that have been mechanically treated, where livestock would trample and consume recovering native herbaceous vegetation and would spread nonnative plant species to soils disturbed by heavy machinery. Livestock grazing would potentially reduce the recovery of herbaceous vegetation following wildfire and managed fire, while at the same time spreading nonnative plant species across burned areas. Livestock concentrate their grazing pressure on new growth vegetation recovering from fire burns and establishing from tree thinning projects. Domestic livestock grazing is probably the most significant cumulative factor potentially adversely affecting native vegetation communities across the project area. Livestock grazing not only directly impacts current vegetation, but also alters long-term plant succession by changing the plant species compositions of early seral stages. Application of resource protection measures, including coordination with permittees on grazing rotations and the control of livestock access to areas undergoing rehabilitation, would mitigate potential impacts. Monitoring would be applied to ensure treated areas are recovering and adaptive management and maintenance applied where appropriate to mitigate adverse impacts from grazing.

Off-highway vehicles, used primarily for recreation, damage soil surfaces and vegetation and spread the seeds of nonnative plant species. Mud on the tires and other parts of off-highway vehicles can transport the seeds of nonnative plants great distances. Off-highway vehicles driving across native herbaceous vegetation, especially in areas already damaged by heavy equipment from project actions, damage or kill plants, and expose soil surfaces to colonization by nonnative plant species. The cumulative effects of off-highway vehicles would be concentrated in certain areas but could potentially damage native vegetation anywhere across the project area.

Nonnative invasive plant species management in the project area and on surrounding lands would act to cumulatively reduce the dominance of nonnative species that compete with native vegetation. Although there would be some localized adverse impacts to native plant communities resulting from management (for example, disturbance from mechanical or manual treatments, herbicide use and potential herbicide drift, that would cause temporary adverse impacts to some non-target native species), in the long term the reduction of invasive nonnative plant species across the project area and surrounding landscape would provide beneficial impacts to native plant communities in the region. By reducing nonnative species dominance across the wider landscape, actions would cumulatively reduce wildfire risk related to the presence of some nonnative plant species that alter natural fire regimes.

As presented in Table 3-15, overall the cumulative impacts of these actions when added to the impacts of the proposed action on the project area would have adverse impacts for vegetation for the duration of prescribed fire or mechanical or herbicide treatments, but beneficial impacts on vegetation for many years post treatment as a result of improved ecosystem functioning, resiliency, and reduced potential for severe wildfire and unwanted fire effects.

Table 3-15. Resource Indicators and Measures for Alternative 2 Cumulative Effect

Resource Element	Resource Indicator	Measure	Alternative 2 Cumulative Effects
Vegetation Community Composition	Vegetation communities or ecological response units; represented by all seral stages and tree density conditions, including old growth, and native and nonnative plant species.	Total acreage of any ecological response unit within the project area no longer supporting the plant species composition and physical structure that define any given ecological response unit.	The application of restoration treatments (outlined in Table 1-8 designed to restore forests and woodland ecological response units to desired reference conditions of pre-European settlement, would result in more open tree stands with reduced wildfire fuels and improved understory vegetation cover, species compositions, and physical structure. Restored ecological response units would be ecologically healthier, with more available soil moisture, nutrients, and sunlight to remaining post-treatment vegetation. Releases of such plant-required resources should also result in improved ecosystem functions such as nutrient cycling, and more resistance and resilience to environmental disturbances such as wildfire, insects and disease, and vulnerability to adverse effects of climate change. Forest and woodland stands would become resistant and resilient to frequent low-severity surface fires. Overall plant species richness and diversity should increase, and habitats for special status sensitive plant species should improve. Resource protection measures would eliminate or greatly reduce the potential adverse impacts of treatment actions such as soil and hydrological disturbances from heavy equipment. This project would add long-term beneficial cumulative impacts to vegetation communities by improving forest resiliency and reducing landscape-scale wildfire hazard.
Vegetation Community Composition	Nonnative plant species composition	Nonnative plant species: Acres occupied by any nonnative invasive plant species within any land area of project-created soil surface disturbance. Post-action monitoring would be required	The application of restoration treatments (outlined in Table 1-8 designed to restore forests and woodland ecological response units to desired reference conditions of pre-European settlement, would not result in increased colonization and spread of nonnative plant species across the ecological response units. Soil disturbance from heavy equipment, and the introduction of nonnative plant species seeds on heavy equipment, are the greatest potential threats of increased nonnative invasive plant species introduction and spread. Resource protection measures aimed and preventing the introduction and spread of nonnative plants would prevent or greatly reduce the potential establishment or spread of nonnative invasive plant species. Restored ecological response units would be ecologically healthier, with more available soil moisture, nutrients, and sunlight to remaining

Resource Element	Resource Indicator	Measure	Alternative 2 Cumulative Effects
			native post-treatment vegetation. Reestablishment of native understory vegetation would provide increased interspecific completion for plant resources to nonnative plants. Forest and woodland stands would become resistant and resilient to frequent low-severity surface fires to which native plants are adapted. Reduced potential for high-severity wildfire would reduce landscape-scale disturbances to soil surfaces that promote the establishment and spread of nonnative invasive plant species across landscapes. This project would add long-term beneficial cumulative impacts to vegetation communities by improving forest resiliency and reducing landscape-scale wildfire hazard.
Forest Structure	Stand Structure	Vegetation Structural Stage	The application of restoration treatments (outlined in Table 1-8) designed to reduce hazardous fuel loading, combined with this project, would assist in creating a more heterogeneous stand structure and a greater balancing of size and age classes, particularly the allocation of old growth, across the wider landscape. This project would add long-term beneficial cumulative impacts to vegetation communities by improving landscape-level forest health and ecosystem functioning.
Forest Structure	Stand Structure	Trees per acre	The application of restoration treatments (outlined in Table 1-8) designed to reduce the number of trees per acre, combined with reductions projected under the proposed action would reduce stand competition, improve residual tree vigor, and reduce vulnerability of individual trees and stands to insect and disease. This project would add long-term beneficial cumulative impacts to vegetation communities by improving forest resiliency and reducing landscape-scale wildfire hazards.
Forest Structure	Stand Structure	Basal area: Total combined square footage of all trees greater than 1 inch DBH	The application of restoration treatments (outlined in Table 1-8) designed to promote larger and more mature trees and reduce densities of smaller trees, results in reduced basal areas in adjacent project boundaries. This combined with the proposed action results in cumulative landscape-level reductions to basal area. This project would add long-term beneficial cumulative impacts to vegetation communities by reducing the potential for catastrophic wildfire on a landscape scale and improving forest health and resiliency.
Forest Structure	Stand Structure	Canopy Cover (%)	The application of restoration treatments (outlined in Table 1-8) designed to open tree canopies and create patchy stand structure would result in reduced canopy cover percentages within adjacent project areas. This combined with the proposed action would add long-term beneficial cumulative impacts to vegetation communities by reducing canopy continuity, reducing shading and promoting greater species composition. Lower canopy cover percentages would reduce potential crown fire initiation and spread. On a landscape scale there would be reduced incidence of high-severity wildfire, lower tree mortality, lower risk to community values at risk, and greater protection of life and property; wildfires that do occur could be contained using various suppression tactics, including direct attack when appropriate.

Resource Element	Resource Indicator	Measure	Alternative 2 Cumulative Effects
Forest Structure	Stand Structure	Crown Base Height (feet)	The application of restoration treatments (outlined in Table 1-8 designed to raise crown base heights—for example, thin from below treatments—would remove dense understory vegetation resulting in higher average base heights in adjacent project areas. This, combined with the proposed action, would add long-term beneficial cumulative impacts to vegetation communities by promoting larger mature trees, reducing understory competition, and reducing the potential for crown fire initiation and therefore reducing potential fire behavior. On a landscape scale there would be reduced incidence of high-severity wildfire, lower tree mortality, lower risk to community values at risk, and greater protection of life and property; wildfires that do occur could be contained using various suppression tactics, including direct attack when appropriate.
Forest Health and Resiliency	Hazardous fuels (fuel loading)	Fuel loading of downed woody fuels (tons/acre).	The application of restoration treatments (outlined in Table 1-8 designed to reduce hazardous fuel loading would alter surface fuels in adjacent project areas. This, combined with the proposed action, would add long-term beneficial cumulative impacts to vegetation communities by reducing wildfire hazard and mitigating wildfire intensity and severity should a wildfire occur. On a landscape scale there would be reduced incidence of high-severity wildfire, lower tree mortality, lower risk to community values at risk, and greater protection of life and property; wildfires that do occur could be contained using various suppression tactics, including direct attack when appropriate.
Forest Health and Resiliency	Fire Regime	Fire Regime Condition Class (FRCC). Degree of departure from the central tendency of reference conditions-Vegetation Condition Class (VCC) would be used as a surrogate.	The application of restoration treatments (outlined in Table 1-8) would better align forest stands within their natural fire regime. This combined with the proposed action would add long-term beneficial cumulative impacts to vegetation communities by mitigating high fuel loading and creating a more heterogeneous forest structure both in terms of size class and age structure. On a landscape scale ecological response units would be more resilient to disturbance by insect and disease, infestations by nonnative species, and fire risk.
Forest Health and Resiliency	Insect and disease	Insect and disease risk.	The application of restoration treatments (outlined in Table 1-8) designed to address hazardous fuel loading, would also serve to reduce insect and disease risk on adjacent project areas, by reducing competition, removing suppressed individuals and improving the overall vigor of residual trees. This combined with the reduced insect and disease risk projected under the proposed action for all ecological response units, would create landscape-scale beneficial impacts for all vegetation communities, reducing the potential incidence of insect and disease outbreaks over a large area.
Wildfire Behavior and Hazard	Wildfire Behavior Parameters	Crowning Index (miles per hour)	The application of restoration treatments (outlined in Table 1-8 designed to address hazardous fuel loading would mitigate (increase) the crowning index, so that higher wind speeds would be needed to transmit crown fire. The crowning index is closely related to canopy cover percent and crown base height and therefore the cumulative impacts of treatments on adjacent lands and as part of the proposed action are the same as described under those measures.

Resource Element	Resource Indicator	Measure	Alternative 2 Cumulative Effects
Wildfire Behavior and Hazard	Wildfire Behavior Parameters	Torching Index (miles per hour)	The application of restoration treatments (outlined in Table 1-8) designed to address hazardous fuel loading would mitigate (increase) the torching index, so that higher wind speeds would be needed to transit torching of individual trees. The torching index is closely correlated to crown base height and percent canopy cover and therefore the cumulative impacts of treatments on adjacent lands and as part of the proposed action are the same as described under those measures.
Wildfire Behavior and Hazard	Wildfire Risk	Fire Risk Rating	Table 1-8

3.2.5 Forest Plan Amendments

The Lincoln National Forest Land and Resource Management Plan amendments would impact fire, fuels, and vegetation communities throughout the project area.

The proposed amendment allowing forest restoration treatments to occur in Mexican spotted owl protected activity centers would result in beneficial impacts to all ecological response unit vegetation communities. As described above, these treatments would reduce stand density, create uneven-aged stands, and create openings. By removing the diameter cap in areas prescribed for free thinning and group selection with matrix thinning, stand heterogeneity can be achieved, even in more mature stands dominated by large-diameter trees. These treatments would help to lower potential fire risk and mitigate catastrophic fire behavior that would damage or destroy habitat components in all ecological response units. A long-term reduction in wildfire risk and beneficial impacts to vegetation communities would result from the proposed amendment. Forest restoration activities within protected activity centers would improve forest health and resilience in a larger portion of the project area, thereby resulting in a decrease in wildfire potential and reduced risk of insect and disease.

Updates to northern goshawk direction would allow treatments to be based on recent science regarding the structural relationship between forest openings or interspaces, tree groups and individuals, canopy cover, and Vegetative Structural Stage classifications. This would facilitate treatment design that would serve to improve habitat components while also having a complementary impact on hazardous fuel reduction. The creation of forest openings would provide fuel breaks across the landscape to mitigate wildfire spread through sensitive habitat. The creation of a range of Vegetative Structural Stage classes improves stand conditions and forest health throughout all ecological response units and improves resiliency to wildfire as well as insect and disease risk.

Updates to general species direction would enable treatments to be implemented to reduce wildfire risk across broader stretches of the project area. Essential habitat components would be protected from potential loss from catastrophic wildfire. This would have a beneficial impact to all ecological response unit vegetation communities and fire and fuels resources in the project area.

Updates to mechanical treatment direction to allow mechanized equipment to be used on slopes greater than 40 percent in the project area to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives would result in beneficial and adverse impacts to all ecological response unit vegetation communities and fire and fuels resource in the project area. Allowing treatments to occur on steeper slopes would provide access to timber that otherwise would not be removed from National Forest System lands. In these areas, treatments would reduce fuel continuity and reduce stand densities, thereby mitigating crown fire potential and the risk of high-intensity stand-replacing wildfire. Long-term beneficial impacts to vegetation communities would result because severe wildfires that are uncharacteristic in a number of the ecological response units in the project area would be mitigated. Furthermore, forest restoration activities on steep slopes would improve the vigor of residual trees by reducing competition for scarce resources, increasing the resilience of stands to insect and disease risk in a larger portion of the project area, and thereby resulting in improved forest health and watershed functioning.

Updates to herbicide use direction to allow chemical treatments to control juniper and oak resprouts would help move ecological response units closer to desired conditions. Herbicide treatments would help to reduce densities of resprouts and encourage recovery of native herbaceous understory. A more open understory would reduce hazardous fuel loading and ladder fuels, mitigating the risk of uncharacteristically high-severity wildfire.

The Forest Plan amendment to authorize the management of unplanned wildfires for multiple resource objectives across portions of the project area where this management is not currently authorized, would also result in long-term reduction in wildfire risk across all ecological response units. Subsequent beneficial impacts to vegetation community resources and fire and fuels would be achieved by allowing the reintroduction of fire into larger areas of fire-dependent vegetation. The reintroduction of fire would help to bring vegetation communities back to within their range of natural variability and help to restore historic fire regimes. By authorizing the management of unplanned wildfire, fewer damaging suppression techniques would need to be applied to areas where fire can safely burn without threatening life and property.

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to vegetation communities and fire and fuels from the no action alternative and proposed action. The proposed action would move vegetation communities closer to historic conditions, returning historic fire regimes to fire-adapted vegetation and reducing the risk of uncharacteristic catastrophic wildfire that impacts long-term woodland and forest health and threatens life, property, community values, and critical infrastructure. By altering stand structure and favoring larger, healthier trees, the incidence of insect and disease would be reduced across all vegetation types. By improving individual tree vigor and creating a more diverse age and size class structure within and between stands, native vegetation communities would move closer to desired conditions, improving ecosystem functioning. The proposed action would result in beneficial effects on native vegetation communities and reductions in the adverse effects of high-severity wildfire over the 20-year life of the project.

3.3 Special Status Plants

3.3.1 Affected Environment

Federally Listed Threatened, Endangered, and Candidate Species

Three federally listed species, presented in Table 3-16, are known to occur or have the potential to occur within the South Sacramento Restoration Project area. A summary of life history, distribution, and threats for each species is provided in the botany biological evaluation (U.S. Forest Service 2018b).

Table 3-16. Federally Threatened, Endangered, and Candidate Plant Species Known to Occur or Potentially Occurring within the Project Area

Species	Status*	Suitable Habitat/ Ecological Response Unit	Known or Potential Occurrence Likely
Kuenzler's hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*)	Threatened (downlisted from Endangered as of June 11, 2018)	Limestone outcrops and gravelly or rocky slopes in grassland, savanna, and woodlands at 5,200 to 6,900 feet elevation. Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland.	Yes
Sacramento Mountains thistle (*Cirsium vinaceum*)	Threatened (without critical habitat)	Travertine deposits and outflows of natural springs within montane coniferous forest habitats and riparian areas at 7,400 to 9,000 feet in the Sacramento Mountains.	Yes
Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*)	Endangered (without critical habitat)	Canyon bottoms and slopes of Chihuahuan desert scrub, savanna, and woodlands at 4,800 to 7,000 feet in the Sacramento Mountains.	Yes

Regional Forester's Sensitive Species

Regional Forester's Sensitive Species were designated in 2013 by the U.S. Forest Service Southwest Regional Office (U.S. Forest Service 2013b). Suitable habitat may exist within the project area for Regional Forester's Sensitive Species listed in Table 3-17. A summary of life history, distribution, and threats for each species is provided in the botany biological evaluation (U.S. Forest Service 2018b).

Table 3-17. Regional Forester's Sensitive Species Considered for the Project

Species	Required Habitat/Ecological Response Unit	Suitable Habitat Present
Chapline's columbine (*Aquilegia chrysantha* var. *chaplinei*)	Endemic to the limestone canyon seeps and springs in the Sacramento Mountains and Chihuahuan desert scrub of the Guadalupe Mountains. Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland	Unknown
Tall milkvetch (*Astragalus altus*)	Endemic species found in limestone soils on steep slopes, openings, and road cuts in lower montane coniferous forest habitats (6,500 to 8,200 feet) of the Sacramento Mountains. Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland, Ponderosa Pine Forest	Yes
Wooton's hawthorn (*Crataegus wootoniana*)	Canyon bottoms and forest understory at elevations of 6,500 to 8,000 feet. Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland, Ponderosa Pine Forest	Yes
Yellow lady's-slipper (*Cypripedium parviflorum* var. *pubescens*)	Full sun to partial shade in bogs, meadows, stream banks, drainages, seepages, and damp woods or higher elevations (8,000 to 11,000 feet). Ponderosa Pine Forest, Mixed Conifer-Frequent Fire Forest, Mixed Conifer with Aspen Forest, Montane Subalpine Grassland	Yes
Villard (Sneed's) pincushion cactus (*Escobaria villardii* / *Escobaria sneedii*)	Loamy soils of desert grassland on broad limestone benches in the western slopes of the Sacramento Mountains (4,500 to 6,500 feet). Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland	Unknown
Wooton's alumroot (*Heuchera wootonii*)	Mountain slopes and, typically, north-facing rock outcrops or Gamble oak thickets in pinyon-juniper woodland and montane coniferous forest in the White and Sacramento Mountains (7,000 to 12,000 feet). Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland, Ponderosa Pine Forest, Mixed Conifer-Frequent Fire Forest, Mixed Conifer with Aspen Forest, Montane Subalpine Grassland	Yes

Species	Required Habitat/Ecological Response Unit	Suitable Habitat Present
Arizona coralroot (*Hexalectris spicata* var. *arizonica)*	Oak woodlands, wooded side canyons, and canyon bottoms of lower elevational range (5,400 feet). Hidden along the drip-line of oaks, pine, and companion shrubs at higher elevational ranges (6,500 feet). Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland	Yes
Wood lily (*Lilium philadelphicum*)	Wetlands and wet meadows associated with open, mature coniferous forests at 7,000 to 10,000 feet in elevation. Pinyon-Juniper Woodland, Ponderosa Pine Forest, Mixed Conifer-Frequent Fire Forest, Mixed Conifer with Aspen Forest, Montane Subalpine Grassland	Yes
Ladies' tresses (green medusa orchid) (*Microthelys rubrocallosa*)	General habitat includes moist gravelly soils in light to moderately wooded south-facing slopes in pine, fir, or oak forests at 6,000 to 9,800 feet in elevation. Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland, Ponderosa Pine Forest, Mixed Conifer-Frequent Fire Forest, Mixed Conifer with Aspen Forest	Yes
Alamo penstemon (also known as Alamo beardtongue) (*Penstemon alamosensis*)	Rocky, limestone bottoms and cool aspect slopes of canyons along the western slopes of the Sacramento Mountains (4,500 to 5,300 feet). May occur on south-facing slopes above 5,300 feet. Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland	Unknown
Cloudcroft scorpionweed (*Phacelia cloudcroftensis*)	Disturbed sites arroyo channels or along roads, in mixed conifer forest down to upper pinyon-juniper woodlands in the Sacramento Mountains (6,500 to 7,700 feet). Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, Gambel Oak Shrubland, Ponderosa Pine Forest, Mixed Conifer-Frequent Fire Forest, Mixed Conifer with Aspen Forest	Yes

Incomplete or Unavailable Information

The information presented in this biological evaluation includes the most recent available geographic distribution and habitat data for each species, as obtained from the Lincoln National Forest botanist and from Natural Heritage New Mexico (2017). When specific survey information is not available or incomplete, the potential occurrence and impact analyses are determined using the best available information, such as the New Mexico Rare Plants Technical Council (2017), the New Mexico Endangered Plant website (New Mexico Energy, Minerals and Natural Resources Department 2017), SEINet (2018), and other species-specific information sources.

3.3.2 Methodology and Assumptions Used for Analysis

The spatial boundary for analyzing the direct and indirect effects on all federally listed threatened, endangered, proposed, and candidate plant species and the Southwest Regional Forester's Sensitive plant species is the South Sacramento Restoration Project boundary because impacts related to vegetation resources are not expected to be impacted outside of this area.

For the purposes of the analysis of direct, indirect, and cumulative effects, short-term effects are those lasting 2 years or less, whereas those effects lasting longer than this are considered to be long-term effects. The proposed project is expected to last approximately 20 years.

Only the rare plant species that are known to occur or may have suitable habitat within the South Sacramento Restoration Project are presented and analyzed in this environmental impact statement. Known occurrences of these plant species are based on survey records at the Lincoln National Forest or other occurrence records in the databases of Natural Heritage New Mexico, and are discussed in detail in the botany biological evaluation (U.S. Forest Service 2018b).

The South Sacramento Restoration Project effects analysis on these rare plant species is based on 1) a determination of the potential for any of these species to occur within any planned forest restoration site in the project area, 2) a determination of the potential for project actions to affect any individuals of any rare plant species within the South Sacramento Restoration Project area, and 3) the requirement that South Sacramento Restoration Project activities and resource protection measures would be employed, in order to avoid project actions from negatively impacting any rare plants.

Resource indicators for federally listed and Regional Forester's sensitive plant species include presence/absence for a given species, population trend, and the presence of suitable habitat within any South Sacramento Restoration Project treatment area (see Table 3-17). Components of suitable habitat include appropriate geographic area, appropriate elevational range above sea level, associated vegetation community type (i.e., ecological response unit type; see below), appropriate soil type (texture and chemistry), appropriate geologic substrate type, and appropriate soil moisture/water saturation conditions (e.g., wetland, xeric, mesic). For some habitat specialist species, components such as soils and hydrology may be key. For other more general species, no particular single habitat component may be important. Each species would be analyzed and evaluated independently, and indicators and measures of project effects would vary according to each species' habitat requirements, if such habitat requirements are known.

Federally Threatened, Endangered, Proposed, or Candidate Species: This section analyzes effects on species individuals and local populations as well as species habitat; disturbance to, loss of, or displacement of individuals; and changes to habitat suitability or availability. Determination of Effects for Species include:

- No Effect;
- Beneficial Affect;
- May Affect, Not Likely to Affect; and
- May Affect, Likely to Adversely Affect.

Regional Forester's Sensitive Species: This section will analyze effects on species individuals, local populations, and species habitat. Species are assumed to be potentially present if suitable habitat is present. The section also analyzes disturbance to, loss of, or displacement of individuals; and changes to habitat suitability or availability, including habitat size and quality. Potential Determination of Impacts include:

- No Impact;
- Beneficial Impact;
- May Impact Individuals, but Not Likely to Cause a Trend to Federal Listing or Loss of Viability; and
- Likely to Result in a Trend Toward Federal Listing or a Loss of Viability for/to the species or its habitat.

Table 3-18. Resource Indicators and Measures for Assessing Project Effects on Plant Species, Habitats, and Population Trends

Resource Element	Resource Indicator	Measure	Used to address the Purpose and Need or Key Issue?
Federally Threatened, Endangered, Proposed, or Candidate species	Effects on species and/or species habitat, effects on Critical Habitat (including primary constituent elements)	Disturbance to or loss of individuals or species populations; changes to habitat; and changes to critical habitat where applicable	Yes
Regional Forester Sensitive Species	Effects on species and/or species habitat	Disturbance to or loss of individuals and species populations; and changes to habitat suitability or availability	Yes

3.3.3 Environmental Consequences

Federally Listed Threatened, Endangered, and Candidate Species

Kuenzler's Hedgehog Cactus (*Echinocereus fendleri* var. *kuenzleri*)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline and the threat of uncharacteristic wildfire would persist.

Alternative 2 – Proposed Action

The proposed action could result in short-term and long-term adverse effects on Kuenzler's hedgehog cactus; however, most of these potential adverse effects would be mitigated through the application of resource protection measures (see Chapter 2, Section 2.2.5).

The proposed action could result in long-term beneficial effects on the species because the restoration treatments may reduce the risk of high-severity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, the species' habitat would likely improve with reduced overstory canopy cover, and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

Since surveys would be conducted prior to implementation of any vegetation thinning treatments (e.g., free thinning or group selection with matrix thinning) and a minimum buffer distance of 100 feet would be applied to the outer perimeter of Kuenzler's hedgehog cactus (unless otherwise determined), it is unlikely that any adverse direct effects would result from vegetation thinning treatments. Furthermore, suitable habitat for Kuenzler's hedgehog cactus generally consists of open areas with minimal tree canopy cover, so long-term indirect effects of vegetation thinning actions may be beneficial to the species if a population occurs within a treatment area, since tree thinning could create more suitable open understory habitat for this species. In addition, vegetation thinning treatments may also benefit

Kuenzler's hedgehog cactus by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Fire in particular has the potential to adversely affect Kuenzler's hedgehog cactus. A study conducted by former New Mexico State Botanist, Bob Sivinski (2007), found that wildfire can cause high mortality in Kuenzler's hedgehog cactus and that populations were slow to recover. A subsequent study of prescribed fire by Wester and Britton (2007) found that Kuenzler's hedgehog cactus burned under average fine fuel conditions (i.e., 600 pounds per acre) were not negatively affected by fire; however, when plants were burned under conditions of high fine fuel loads (1,200 pounds per acre) the mortality rate increased (Wester and Britton 2007). In light of these study results, areas occupied by Kuenzler's hedgehog cactus may be excluded from prescribed fire activities where heavier fine fuel loads occur. Due to resource protection measure Rx-8 and others previously mentioned, it is unlikely that prescribed fire would result in any direct adverse effects on Kuenzler's hedgehog cactus. Long-term indirect effects of fire management may be beneficial to the species, because frequent surface fire would maintain open habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for crown fire.

Effects from Targeted Herbicide Applications

Herbicides were designed to inhibit or destroy plants; so there is little doubt that using herbicides to control juniper and oak resprouts has the potential to affect Kuenzler's hedgehog cactus. The selectivity of the herbicides proposed for use varies. Therefore, these herbicides have the potential to kill or damage any plant that is immediately adjacent or intermingled with juniper and oak, including Kuenzler's hedgehog cactus. However, resource protection measures were designed to mitigate such risks, including SOP-3, Plant-3, Herbicide-1, Herbicide-3, Herbicide-5, and Herbicide-6. Beneficial long-term indirect effects of herbicide treatments may include creating more suitable habitat.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, improvement of recreation sites, and interpretive sites may be necessary to achieve desired conditions. Since surveys would be conducted prior to implementation of any restoration methods and a minimum buffer distance of 100 feet would be applied to the outer perimeter of Kuenzler's hedgehog cactus (unless otherwise determined) (resource protection measure Plant-3), it is unlikely that any adverse direct effects would result from these restoration methods. Long-term indirect effects of these restoration methods would likely benefit Kuenzler's hedgehog cactus by improving suitable habitat conditions. For example, site rehabilitation activities may include reseeding native grasses and forbs in an area with exposed, bare mineral soil. Such an action would reduce the potential for erosion, water runoff, and invasion by nonnative invasive plant species. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied Kuenzler's hedgehog cactus sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 200 feet uphill and 100 feet below and alongside areas occupied by federally listed plant species, including Kuenzler's hedgehog cactus. This buffer zone would be delineated from the outer perimeter of Kuenzler's hedgehog cactus populations and shall be marked prior to implementing site-specific activities (measure Plant-3). As a result, no direct adverse effects are anticipated for Kuenzler's hedgehog cactus. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects on Kuenzler's hedgehog cactus. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat for Kuenzler's hedgehog cactus. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Also included in this section is the development of rock pits (and associated access routes) to supply materials for road maintenance and watershed improvement efforts. Again, these rock pits would be located more than 200 feet uphill and 100 feet below and alongside areas occupied by Kuenzler's hedgehog cactus and the buffer zone would be delineated from the outer perimeter of Kuenzler's hedgehog cactus populations, prior to implementation of site-specific activities (measure Plant-3). Therefore, no direct adverse effects are anticipated for Kuenzler's hedgehog cactus. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operation of a rock pit, creation and use of rock pits may result in long-term indirect adverse effects on Kuenzler's hedgehog cactus. Such a disturbance may result in soil compaction, soil displacement, erosion, water runoff, and colonization of nonnative invasive plant species. However, to the extent possible rock pits would be located near existing system roads to minimize the need for road construction and reconstruction (measure Rock-1); thereby reducing the amount of new disturbance areas on the forest. Furthermore, in an effort to reduce the introduction and spread of nonnative invasive plant species, newly constructed pits would avoid areas with nonnative invasive plants (measure Rock-2) and disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18). As much soil as possible would be saved during excavation operations to aid in site rehabilitation (measure Rock-4). In addition, protection measures would be put in place to prevent off-site runoff and soil displacement (measure Rock-4). Restoration and site rehabilitation efforts would include: restoring slopes in excess of 50 percent slope to less than 50 percent slope; and, replacing saved topsoil, and replanting/reseeding with native vegetation as approved by a qualified Forest Service botanist or designated representative (measure Rock-5). Resource protection measures such as these would help reduce the risk of indirect adverse effects on Kuenzler's hedgehog cactus individuals and suitable habitat, but it would not completely mitigate the risks.

Effects from Road Management

Road construction and maintenance is one of the most widespread forms of habitat modification of the past century (Trombulak and Frissell 2000). The ecological effect a road has on the surrounding environment varies greatly depending on location, design, and maintenance. Nonetheless, roads can adversely affect the surrounding environment in several ways, such as habitat fragmentation (Hansen and Clevenger 2005), alterations of the physical and chemical environment (Trombulak and Frissell 2000), and the introduction and spread of nonnative invasive species (Hansen and Clevenger 2005; Trombulak and Frissell 2000; Von der Lippe and Kowarik 2007), just to name a few. For this project, road management activities such as road construction, reconstruction, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, approximately 125 miles of temporary and system roads would be constructed to support project implementation. These actions are not likely to have any direct adverse effects on Kuenzler's hedgehog cactus because surveys would be conducted prior to implementing road management activities and a minimum buffer distance of 100 feet would be applied to the outer perimeter of Kuenzler's hedgehog cactus (unless otherwise determined) (measure Plant-3). Additionally, some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts), and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.) may benefit Kuenzler's hedgehog cactus by improving habitat conditions. Road management would also include rehabilitation of unauthorized or user-created routes, especially where significant resource damage, such as soil erosion, is occurring. Proposed treatments would restore unauthorized routes to a more natural state thereby improving watershed health and Kuenzler's hedgehog cactus habitat conditions.

Effects from Adaptive Management, Monitoring, and Maintenance

The adaptive management component that allows managers the flexibility to implement projects, monitor the results, and adapt future treatments based on the results of earlier treatments would reduce the risk to Kuenzler's hedgehog cactus even further than is already afforded under the resource protection measures.

Maintenance treatments would have similar effects on those analyzed in each section for the initial implementation of treatments but generally to a lesser degree.

Cumulative Effects

See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on Kuenzler's hedgehog cactus.

Past actions and natural disturbances, including fire suppression, wildfires, timber harvests, insect and disease attacks, power line installation, water extraction, livestock grazing, and construction of range improvements have contributed to the current environmental conditions and many of these past actions are likely to continue in the reasonably foreseeable future.

While it is possible that wildland fire management activities on both federal and state lands may affect Kuenzler's hedgehog cactus, a separate decision support process is used to guide and document wildfire management decisions (Fire Executive Council 2009). None of the other projects listed in Table 3-1 are known to support Kuenzler's hedgehog cactus populations, therefore these projects would not directly or indirectly affect Kuenzler's hedgehog cactus and would not contribute any cumulative effects. The one exception is nonnative invasive species management. Herbicides used to treat nonnative invasive plants on federal, state, and private lands may contribute to cumulative adverse effects if they are not applied correctly or result in off-target damage. However, treatment of nonnative invasive plant species may also reduce their presence on the landscape, thereby improving habitat conditions. In addition, non-treatment elements, such education, outreach, monitoring, and inventory of nonnative invasive species, may also contribute to a reduction in their population numbers across the landscape.

Determination for Kuenzler's Hedgehog Cactus

This determination is based on the best available science and relevant scientific information, and where appropriate, acknowledge incomplete or unavailable information, scientific uncertainty, and risk.

The proposed action would not result in any short-term direct effects on Kuenzler's hedgehog cactus, because resource protection measures would ensure that planning and implementation of any project treatment activities would avoid all individuals found during pre-implementation surveys. Most long-term indirect effects would be beneficial to the species by improving watershed function and decrease the risk of uncharacteristic wildfire, which is considered moderate threat to Kuenzler's hedgehog cactus. However, some proposed actions such as the development of sorting yards, log processing sites, mobile incinerators, rock pits, etc., under a Special Use Authorization may result in long-term indirect adverse impacts to Kuenzler's hedgehog cactus. Based on the analysis above, the effects of activities proposed for the South Sacramento Restoration Project are insignificant or discountable, therefore the proposed actions **may affect but are not likely to adversely affect** individuals or local populations of Kuenzler's hedgehog cactus and its habitat within the proposed project area. Insignificant effects relate to the size of the impact and should not reach the scale where take occurs. Discountable effects are considered extremely unlikely to occur. Based on best judgment, a person would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects or 2) expect discountable effects to occur.

Sacramento Mountains Thistle (*Cirsium vinaceum*)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline and the threat of uncharacteristic wildfire would persist.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Action activities in Ponderosa Pine Forest, Mixed Conifer-Frequent Fire Forest, and Mixed Conifer with Aspen Forest ecological response units have the potential to affect the Sacramento Mountains thistle. However, surveys would be conducted for the Sacramento Mountains thistle where suitable habitat exists. If surveys are not feasible prior to implementation, such suitable habitat areas would be treated as if occupied. Surveys would be conducted at the appropriate time of year for plant identification, and U.S. Fish and Wildlife Service–approved survey protocols would be followed. If approved protocols have not been established for a species, then subsequent surveys and treatments would be coordinated with the U.S. Fish and Wildlife Service prior to implementation (measure SOP-3). A buffer zone would be applied around each occurrence of this species, depending on the site-specific conditions as directed by the U.S. Fish and Wildlife Service, and as consistent with recovery plans, conservation plans, agreements, species assessments, and/or Forest Service policy. Where no such guidance is expressly given, a minimum buffer distance of 200 feet uphill and 100 feet below and alongside occupied areas would be delineated. These buffer zones would be delineated from the outer perimeter of all federally listed and proposed plant populations and shall be marked prior to implementing site-specific activities (measure Plant-3). In addition, prior to scheduling implementation activities, a qualified Forest Service botanist or designated representative would be consulted to ensure resource protection measures are applied appropriately (measure Plant-1). This consultation would be coordinated through interdisciplinary development of an annual treatment plan (measure SOP-1) and annual pre-operations briefing to ensure all appropriate resource protection measures are followed (measure SOP-2).

Effects from Vegetation Thinning

Vegetation thinning treatments (free thinning, thin from below, and matrix thinning) would not likely result in any direct adverse impacts to individuals of Sacramento Mountains thistle because suitable habitat would be surveyed and if found, populations would be buffered and avoided, as described above. However, some actions associated with vegetation thinning may indirectly affect Sacramento Mountains thistle, over a short-term period. For example, soil and hydrological resource damage from the use of heavy equipment might indirectly affect hydrologic function within suitable habitat downslope of treated areas by compacting soils; thereby reducing vegetative ground cover and increasing soil erosion and sediment delivery to nearby water sources. As a result, several resource protection measures have been designed to minimize soil and hydrologic resource damage. Such resource protection measures include establishing aquatic management zones—administratively designated zones adjacent to streams channels and other waterbodies—and applying special management controls aimed at minimizing on-site soil movement in these sensitive areas, and maintaining and improving water quality and other water-/riparian-dependent values (measure SOP-6). In addition, landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to federally listed species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites, where possible, so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Furthermore, skid trails, landings, staging areas, yarding decks, and logging decks would be located outside of aquatic management zones and wet meadows (measure Veg-9). Skidding across intermittent and ephemeral channels would only occur at designated locations (measure Veg-10) and the number of crossings would be minimized to the extent practicable (measure Water-5).

Hand thinning methods are preferred within aquatic management zones and wet meadows; and no trees that are stabilizing or maintaining the integrity of any seep, spring, or perennial, intermittent, or ephemeral drainage would be cut (measures Water-2, Water-4, and Veg-11). While hand thinning may also affect Sacramento Mountains thistle in the short term, less soil compaction and erosion, loss of vegetative cover, and loss of individuals or populations of this species would occur and treated sites are expected to recover more quickly than areas treated mechanically. Long-term indirect effects of vegetation thinning treatment may be beneficial to Sacramento Mountains thistle, since these proposed actions were designed to improve watershed health and potentially the hydrologic function of aquatic management zones, springs, and seeps.

Effects from the Use of Fire

Prescribed fire would not likely result in any direct adverse impacts to individuals of Sacramento Mountains thistle because suitable habitat would be surveyed and if found, populations would be buffered and avoided, as described above. Fire line construction would result in short-term soil disturbance that may potentially result in some long-term indirect effects on Sacramento Mountains thistle, such as resource competition from nonnative invasive plants. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. With regard to the Sacramento Mountains thistle, teasel (*Dipsacus sylvestris*) has been shown to directly displace individuals through competitive pressure (Huenneke and Thomson 1995). It appears this is partially due to teasel's superior ability to germinate in the dark (i.e., closed canopy). A number of other nonnative invasive species have been observed with Sacramento Mountains thistle, including musk thistle (*Carduus nutans*), mullein (*Verbascum thapsus*), bull thistle (*Cirsium vulgare*), tamarisk (*Tamarix chinensis*), and Siberian elm (*Ulmus pumila*) (Roth 2013).

However, natural barriers and existing roads would be used to limit soil disturbance, whenever possible (measure Rx-6). If fire lines are put in place for prescribed fire activities, they would be promptly rehabilitated as needed (measure Rx-7 and SOP-14). Furthermore, in areas where ground-disturbing activities are expected, surveys would be conducted for nonnative invasive plants prior to implementation, weed-free staging areas would be designated, and known infestations would be avoided (measure SOP-17). Long-term indirect effects on Sacramento Mountains thistle are not anticipated because fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover in areas around thistle populations are maintained overall (measure Rx-8). In addition, the size of slash piles and locations would be negotiated with resource specialists so as to minimize losses of the native seed bank and reduce impacts to soils and watersheds. In order to limit overall disturbance and reduce the potential for nonnative invasive plants to establish, slash piles would be placed in areas that were previously disturbed, whenever possible (measure Rx-3).

Effects from Targeted Herbicide Applications

Herbicides were designed to inhibit or destroy plants; and several of the herbicides identified for use in the proposed action are used specifically for the control of nonnative invasive thistles (see Appendix B). So, there is little doubt that using these herbicides to control juniper and oak resprouts has the potential to affect Sacramento Mountains thistle. While the selectivity of herbicides varies, all herbicides have the potential to kill or damage any federally listed plant that is immediately adjacent or intermingled with target species. However, herbicide applications to juniper and oak resprouts would not have direct adverse effects on the Sacramento Mountains thistle, because (1) such treatments would not occur in wetland habitats, and (2) resource protection measures were designed to reduce the risk associated with applications procedures by ensuring thoughtful and careful use around federally listed plants. Surveys would be conducted prior to implementation (measure SOP-3) of herbicide use, and a minimum avoidance buffer of 200 feet uphill and 100 feet below and alongside occupied areas would be delineated from the outer perimeter of Sacramento Mountains thistle populations (measure Plant-3). Additionally, when herbicides are used there is the risk of indirect effects from accidental spills, especially spills associated with with storage, transport, and disposal. Indirect adverse effects on Sacramento Mountains thistle populations would be minimized by only applying herbicides within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and ensuring that application rates would not exceed herbicide label instructions (measure Herbicide-3), which would be tracked through daily pesticide application logs (measure Herbicide-5). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6).

Overall, long-term indirect effects of herbicide treatments may be beneficial to the species, by creating improved watershed health and hydrologic function.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, improvement of recreation sites, and interpretive sites may be necessary to achieve desired conditions. Since surveys would be conducted prior to implementation of any restoration methods and a minimum buffer distance of 100 feet would be applied to the outer perimeter of Sacramento Mountains thistle (unless otherwise determined), it is unlikely that any adverse direct effects would result from these restoration methods. In fact, the long-term indirect effects of several of these restoration methods would likely benefit Sacramento Mountains thistle by improving suitable habitat conditions. For example, site rehabilitation activities may include reseeding native grasses and forbs in an area with exposed, bare mineral soil. Such an action would reduce the potential for erosion, water runoff, stream sedimentation, and invasion by nonnative invasive plant species. Watershed improvement activities would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Sacramento Mountains thistle habitat to the adverse effects of climate change-induced drought. Likewise, recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, such as Sacramento Mountains thistle, which may result in less intensive use. Other activities such as water developments may have some positive and negative effects for Sacramento Mountains thistle. Water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied Sacramento Mountains thistle habitat; however, additional water developments may adversely affect this species by curtailing natural surface flows. A situation was described in the listing rule for Sacramento Mountains thistle where an unauthorized 1,900-foot-long pipeline and cement spring box was constructed at a thistle site, which negatively impacted nearby plants by impeding water flow (*Federal Register* 52, page 22933). This unauthorized spring development near Bluff Springs resulted in an 84 percent loss of thistles, from 300 plants in 1984 to 47 plants in 1991 (U.S. Fish and Wildlife Service 1993).

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 200 feet uphill and 100 feet below and alongside areas occupied by Sacramento Mountains thistle. This buffer zone would be delineated from the outer perimeter of Sacramento Mountains thistle populations and shall be marked before implementing site-specific activities (measure Plant-3). Furthermore, these designated Special Use areas would be more than 100 feet from perennial and intermittent stream channels, wet meadows, and springs (measures SOP-6 and Water-1); and more than 15 feet from ephemeral channels (measure SOP-6). As a result, no direct adverse effects are anticipated for Sacramento Mountains thistle. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects on Sacramento Mountains thistle. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat for Sacramento Mountains thistle. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. With regard to the Sacramento Mountains thistle, teasel has been shown to directly displace individuals through competitive pressure (Huenneke and Thomson 1995), and a number of other nonnative invasive species have also been observed with Sacramento Mountains thistle on the forest, including musk thistle, mullein, bull thistle, tamarisk, and Siberian elm (Roth 2013). However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Also included in this section is the development of rock pits (and associated access routes) to supply materials for road maintenance and watershed improvement efforts. Again, these rock pits would be located more than 200 feet uphill and 100 feet below and alongside areas occupied by Sacramento Mountains thistle and the buffer zone would be delineated from the outer perimeter of Sacramento Mountains thistle populations, before implementation of site-specific activities (measure Plant-3). Therefore, no direct adverse effects are anticipated for this species. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operation of a rock pit, creation and use of rock pits may result in long-term indirect adverse effects on Sacramento Mountains thistle. Such a disturbance may result in soil compaction, soil displacement, erosion, water runoff, and colonization of nonnative invasive plant species. However, to the extent possible rock pits would be located near existing system roads to minimize the need for road construction and reconstruction (measure Rock-1); thereby reducing the amount of new disturbance areas on the forest. Constructed pits would not be located in aquatic management zones, channel buffers, or wet meadows, and would avoid areas with nonnative invasive plants (measure Rock-2). In an effort to reduce the introduction and spread of nonnative invasive plant species, newly disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18). As much soil as possible would be saved during excavation operations to aid in site rehabilitation (measure Rock-4). In addition, protection measures would be put in place to prevent off-site runoff and soil displacement (measure Rock-4). Restoration and site rehabilitation efforts would include: restoring slopes in excess of 50 percent slope to less than 50 percent slope; and, replacing saved topsoil and replanting/reseeding with native vegetation as approved by a qualified Forest Service botanist or designated representative (measure Rock-5). Resource protection measures such as these would help reduce the risk of indirect adverse effects on Sacramento Mountains thistle individuals and suitable habitat.

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, approximately 125 miles of temporary and system roads would be constructed to support project implementation. These actions may result in a wide range of effects on Sacramento Mountains thistle including some short- and long-term adverse indirect effects as well as some beneficial effects; however, no direct effects are likely to occur because surveys would be conducted before implementation of road management activities. In addition, a minimum buffer distance of 100 feet would be applied to the outer perimeter of Sacramento Mountains thistle (unless otherwise determined) (measure Plant-3).

The ecological effect a road has on the surrounding environment varies greatly depending on location, design, and maintenance. However, roads can adversely affect the surrounding environment through habitat fragmentation (Hansen and Clevenger 2005), alterations of the physical and chemical environment (Trombulak and Frissell 2000), and the introduction and spread of nonnative invasive species (Hansen and Clevenger 2005; Trombulak and Frissell 2000; Von der Lippe and Kowarik 2007). Roads and off-highway vehicle trails are two causes of channelization, contributing to habitat fragmentation. In addition, the roads and trails channelize the water flow, and block water from reaching downslope habitat, which results fragmentation of the habitat and decreased succession of individuals. This reduced connectivity limits Sacramento Mountains thistle ability to move into adjacent areas, to colonize suitable habitat or utilize habitat that fulfills its life cycle needs, including gene flow (Craddock and Huenneke 1997). Wet travertine deposits, though rare and spotty in distribution, vary in size from several square feet to 5 acres (Roth 2013). These deposits are the most densely populated expanses of suitable habitat, whereas wet areas downstream are more sparsely inhabited by Sacramento Mountains thistle. It has been noted that while several areas around the Sacramento Ranger District contain suitable spring habitat for the Sacramento Mountains thistle, these sites remain unoccupied (U.S. Fish and Wildlife Service 1993). However, restricted distribution of this species within suitable habitat is likely the result of habitat degradation and land use along streams between travertine seeps (Craddock and Huenneke 1997). In fact, Craddock and Huenneke (1997) note that where riparian habitat conditions have improved, Sacramento Mountains thistle has successfully colonized lengthy corridors between more discrete populations. Furthermore, their study revealed that certain characteristics of Sacramento Mountains thistle seeds (i.e., high viability, float time, and distance traveled) may indicate a specific adaptation to aquatic seed dispersal (Craddock and Huenneke 1997). As a result, the condition of spring sites and riparian habitat play a crucial role in perpetuation of Sacramento Mountains thistle individuals, and the implementation of this project should improve these areas which would benefit the species.

Timber management, with temporary roads, landings, and logging decks, could also contribute to channelization. Furthermore, soil compaction resulting from these management activities has the potential to alter hydrological regimes and could contribute to habitat fragmentation. Proposed road maintenance activities 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. In addition, stream crossings and stream interactions would be evaluated to reduce impacts from the roads to streams, soils, and watersheds. Furthermore, sections of open road currently located along canyon bottoms may be relocated as opportunities arise to mitigate resource damage. Road management would also include rehabilitation of unauthorized or user-created routes, especially where significant resource damage, such as soil erosion, is occurring. Proposed treatments would restore unauthorized routes to a more natural state and would include the following actions: blocking entrances, revegetating and installing water bars, removing fills and culverts, establishing drainageways and removing unstable road shoulders, and recontouring and restoring natural slopes. These actions would improve habitat conditions for Sacramento Mountains thistle by improving hydrologic flows, which could increase suitable habitat connectivity, thereby improving current habitat and potentially creating more suitable habitat.

Effects from Adaptive Management, Monitoring, and Maintenance

The adaptive management component that allows managers the flexibility to implement projects, monitor the results, and adapt future treatments based on the results of earlier treatments would reduce the risk to Sacramento Mountains thistle even further than is already afforded under the resource protection measures.

Maintenance treatments would have similar effects on those analyzed in each section for the initial implementation of treatments but generally to a lesser degree.

Cumulative Effects

Past actions and natural disturbances, including fire suppression, wildfires, timber harvests, insect and disease attacks, power line installation, water extraction, livestock grazing, and construction of range improvements have contributed to the current environmental conditions and many of these past actions are likely to continue in the reasonably foreseeable future.

While it is possible that wildland fire management activities on both federal and state lands may affect Sacramento Mountains thistle, a separate decision support process is used to guide and document wildfire management decisions (Fire Executive Council 2009), and the effects of Wildland Fire Management activities are not considered here.

Mechanical treatments and other restoration activities on the forest, adjacent state lands, and tribal lands would further increase long-term forest health as a result of reduced risk of wildfire, which could improve the forest's resiliency in a changing climate and decrease the potential for soils to erode and create sediment problems within streams and riparian areas. The overall long-term cumulative effects from these other projects should result in beneficial effects on Sacramento Mountains thistle, although there may be minor short-term increases in soil erosion and compaction, and water runoff and sedimentation while these treatments are being implemented and possibly for up to 2 years after.
The primary management action that would have potential adverse cumulative effects on the Sacramento Mountains thistle is the use of herbicide to treat nonnative invasive plants. Herbicides used to treat nonnative invasive plants on federal, state, and private lands may contribute to cumulative adverse effects if they are not applied correctly or result in off-target damage. As previously mentioned in the Effects from Targeted Herbicide Applications section above, herbicides were designed to inhibit or destroy plants; and many of those are used specifically for the control of nonnative invasive thistles. However, treatment of nonnative invasive plant species may also reduce their presence on the landscape, thereby improving habitat conditions for Sacramento Mountains thistle, which is especially vulnerable to invasions of musk thistle and teasel. In addition, non-treatment elements, such education, outreach, monitoring, and inventory of nonnative invasive species may also lead to a reduction in their population numbers across the landscape.

Determination for Sacramento Mountains Thistle

This determination is based on the best available science and relevant scientific information, and where appropriate, acknowledge incomplete or unavailable information, scientific uncertainty, and risk.

The proposed action would not result in any short-or long-term direct effects on Sacramento Mountains thistle, because resource protection measures would ensure that planning and implementation of project treatment activities would avoid all individuals found during pre-implementation surveys. Most long-term indirect effects would benefit this species by decreasing the risk of uncharacteristic wildfire and improving watershed function. However, some indirect effects, such as the introduction/spread of nonnative invasive species, may result from the proposed action. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. Based on the analysis above, the effects of activities proposed for the South Sacramento Restoration Project are insignificant or discountable, therefore the proposed actions

may affect but are not likely to adversely affect individuals or local populations of Sacramento Mountains thistle and its habitat within the proposed project area. Insignificant effects relate to the size of the impact and should not reach the scale where take occurs. Discountable effects are considered extremely unlikely to occur. Based on best judgment, a person would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects or 2) expect discountable effects to occur.

Sacramento Prickly Poppy (*Argemone pleiacantha* var. *pinnatisecta*)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline and the threat of uncharacteristic wildfire would persist.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Sacramento prickly poppies would not be located in areas that are proposed for treatment. In fact, there are no known populations of Sacramento prickly poppy within the South Sacramento Restoration Project boundary; therefore no short-term or long-term direct affects would occur for this species. However, populations are located downslope from proposed treatment areas and may be indirectly affected by treatments occurring in Pinyon-Juniper Woodland, Pinyon-Juniper Grassland, Mountain Mahogany Mixed Shrubland, and Gambel Oak Shrubland ecological response units; therefore, only potential indirect effects on Sacramento prickly poppy are described in this biological evaluation.

Resource protection measures were designed to avoid or minimize any potential adverse effects. Furthermore, before implementation activities are scheduled, a qualified Forest Service botanist or designated representative would be consulted to ensure resource protection measures are applied appropriately (measure Plant-1). This consultation would be coordinated through interdisciplinary development of an annual treatment plan (measure SOP-1) and annual pre-operations briefing to ensure all appropriate resource protection measures are followed (measure SOP-2).

Effects from Vegetation Thinning

Some actions associated with vegetation thinning may indirectly affect Sacramento prickly poppy, over a short-term period. For example, soil and hydrological resource damage from the use of heavy equipment might indirectly affect hydrologic function within suitable habitat downslope of treated areas by compacting soils; thereby reducing vegetative ground cover and increasing soil erosion and sediment delivery downslope to nearby water sources. As a result, several resource protection measures have been designed to minimize soil and hydrologic resource damage. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation (measure Veg-5). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8). Slash piles would be placed on previously disturbed sites, where possible, so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16).

While vegetation treatments may pose a slight risk Sacramento prickly poppy through short-term increased erosion and altered hydrologic function, vegetation thinning treatments upslope may benefit Sacramento prickly poppy by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy. High-intensity wildfire could also lead to increased erosion and altered hydrologic function but at much greater scale, at a greater intensity and for a longer duration than vegetation treatments. Furthermore, vegetation thinning treatments would improve watershed health and hydrologic function, in the long term, which should enhance habitat conditions for the Sacramento prickly poppy.

Effects from the Use of Fire

Indirect effects on Sacramento prickly poppy from prescribed fire may include short-term increases in erosion, altered hydrologic function, and the introduction and spread of nonnative invasive species from fire line construction, pile burning, and broadcast burning activities.

Fire line construction would result in short-term soil disturbance that may potentially result in some long-term indirect effects on Sacramento prickly poppy, such as resource competition from nonnative invasive plants. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, natural barriers and existing roads would be used whenever possible to reduce the need for fire line construction, thereby limiting soil disturbance (measure Rx-6). In addition, drainage structures, such as waterbars, rolls, dips, and armor, would be constructed along fire containment lines as needed to prevent erosion and runoff (measure Rx-6). If fire lines are put in place for prescribed fire activities, they would be promptly rehabilitated as needed (measures Rx-7 and SOP-14). Furthermore, in areas where ground-disturbing activities are expected, surveys would be conducted for nonnative invasive plants prior to implementation, weed-free staging areas would be designated, and known infestations would be avoided (measure SOP-17).

Fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover would be maintained overall (measure Rx-8). This would reduce the risk of soil erosion downslope, which has the potential to alter suitable habitat for Sacramento prickly poppy. In addition, the size of slash piles and locations would be negotiated with resource specialists so as to minimize losses of the native seed bank and reduce impacts to soils and watersheds. Furthermore, in order to limit overall disturbance and reduce the potential for nonnative invasive plants to establish, slash piles would be placed in areas that were previously disturbed, whenever possible (measure Rx-3). After piles are burned, the bare soils may be scarified and/or lightly covered with small woody debris to reduce potential erosion and encourage vegetation growth (measure Rx-9). Long-term indirect effects of prescribed fire use would improve watershed health and hydrologic function, which should enhance habitat conditions for the Sacramento prickly poppy and reduce the risk of high-intensity wildfire.

Effects from Targeted Herbicide Applications

Proposed herbicide use would be applied to juniper and oak resprouts using targeted methods to minimize impacts to federally listed and other sensitive plant species. The use of resource protection measures relative to applications procedures would prevent herbicides from dispersing to open suitable habitat areas. Herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3), which would be tracked through daily pesticide application logs (measure Herbicide-5). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be no effects on Sacramento prickly poppy.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management, are not likely to have any indirect adverse effects on Sacramento prickly poppy. However, long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Sacramento prickly poppy habitat (damp soils) to the adverse effects of climate change-induced drought.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 200 feet uphill and 100 feet below and alongside areas occupied by federally listed plant species, including Sacramento prickly poppy. This buffer zone would be delineated from the outer perimeter of Sacramento prickly poppy populations and shall be marked prior to implementing site-specific activities (measure Plant-3). As a result, no direct adverse effects are anticipated for this species. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects on Sacramento prickly poppy. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat for Sacramento prickly poppy. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Also included in this section is the development of rock pits (and associated access routes) to supply materials for road maintenance and watershed improvement efforts. Again, these rock pits would be located more than 200 feet uphill and 100 feet below and alongside areas occupied by Sacramento prickly poppy and the buffer zone would be delineated from the outer perimeter of a population, prior to implementation of site-specific activities (measure Plant-3). Therefore, no direct adverse effects are anticipated for Sacramento prickly poppy. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operation of a rock pit, creation and use of rock pits may result in long-term indirect adverse effects on Sacramento prickly poppy. Such a disturbance may result in soil compaction, soil displacement, erosion, water runoff, and colonization of nonnative invasive plant species. However, to the extent possible rock pits would be located near existing system roads to minimize the need for road construction and reconstruction (measure Rock-1), thereby reducing the amount of new disturbance areas on the forest. Furthermore, in an effort to reduce the introduction and spread of nonnative invasive plant species, newly constructed pits would avoid areas with nonnative invasive plants (measure Rock-2) and disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18). As much soil as possible would be saved during excavation operations to aid in site rehabilitation (measure Rock-4). In addition, protection measures would be put in place to prevent off-site runoff and soil displacement (measure Rock-4). Restoration and site rehabilitation efforts would include: restoring slopes in excess of 50 percent slope to less than 50 percent slope; and, replacing saved topsoil and replanting/reseeding with native vegetation as approved by a qualified Forest Service botanist or designated representative (measure Rock-5). Resource protection measures such as these would help reduce the risk of indirect adverse effects on Sacramento prickly poppy individuals and suitable habitat.

Effects from Road Management

Roads can adversely affect the surrounding environment through habitat fragmentation (Hansen and Clevenger 2005), alterations of the physical and chemical environment (Trombulak and Frissell 2000), and the introduction and spread of nonnative invasive species (Hansen and Clevenger 2005; Trombulak and Frissell 2000; Von der Lippe and Kowarik 2007). No road maintenance activities are proposed where Sacramento prickly poppy occur; however, some of the maintenance activities proposed, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts), and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.) may benefit Sacramento prickly poppy by improving habitat conditions. Road management would also include rehabilitation of unauthorized or user-created routes, especially where significant resource damage, such as soil erosion, is occurring. Proposed treatments would restore unauthorized routes to a more natural state thereby improving watershed health.

Cumulative Effects

Past actions and natural disturbances, including fire suppression, wildfires, timber harvests, insect and disease attacks, power line installation, water extraction, livestock grazing, and construction of range improvements have contributed to the current environmental conditions and many of these past actions are likely to continue in the reasonably foreseeable future.

While it is possible that wildland fire management activities on both federal and state lands may affect Sacramento prickly poppy, a separate decision support process is used to guide and document wildfire management decisions (Fire Executive Council 2009). Only a few of the federal and non-federal actions listed in Table 3-1 are known to support Sacramento prickly poppy populations, including Nonnative Invasive Species Management and Westside Sacramento Mountains Watershed Restoration and Fuels Reduction Project – Priority Areas 1 and 3. Mechanical treatments and other restoration activities on the forest, adjacent state lands, and tribal lands should further increase long-term forest health as a result of reduced uncharacteristic wildfire risk, which could improve the forest's resiliency in a changing climate and decrease the potential for soils to erode and create sediment problems within streams and riparian areas. The overall long-term cumulative effects from these other projects should result in beneficial effects on Sacramento prickly poppy, although there may be a minor short-term increase in soil erosion and compaction, and water runoff and sedimentation while these treatments are being implemented and possibly for up to 2 years after.

Determination for the Sacramento Prickly Poppy

This determination is based on the best available science and relevant scientific information, and where appropriate, acknowledge incomplete or unavailable information, scientific uncertainty, and risk.

Since there are no known populations of Sacramento prickly poppy within the South Sacramento Restoration Project boundary nor is any suitable habitat is present, no short-term or long-term direct effects on Sacramento prickly poppy would result from implementation of the proposed action alternative. However, populations of this species are located downslope from proposed treatment areas and may be indirectly affected. For most treatment actions, the most probable adverse indirect affect would be a short-term increase in soil erosion and short-term altered hydrologic function. Long-term indirect effects may include adverse effects such as the introduction and spread of nonnative invasive plants and beneficial effects such as decreased risk of uncharacteristic wildfire and improved watershed function. Based on the analysis above, the effects of activities proposed for the South Sacramento Restoration Project are insignificant or discountable, therefore the proposed actions **may affect but are not likely to adversely affect** individuals or local populations of Sacramento prickly poppy and its habitat within the proposed project area. Insignificant effects relate to the size of the impact and should not reach the scale where take occurs. Discountable effects are considered extremely unlikely to occur. Based on best judgment, a person would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects or 2) expect discountable effects to occur.

Regional Forester's Sensitive Species

Chapline's Columbine (Aquilegia chrysantha var. *chaplinei)*

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline and the threat of uncharacteristic wildfire would persist.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Any activities that alter local hydrological processes may adversely affect this species as it is associated with wet rocky riparian areas and limestone seeps and springs. However, resource protection measures outlined in Chapter 2, Section 2.2.5 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term minor impacts to Chapline's columbine. Mechanical treatments would not occur within the aquatic management zones (including riparian or wetland environments) that are associated with this species. However, heavy equipment use adjacent to these zones could result in removal or damage to individuals or populations that may occur outside of the designated aquatic management zones. Additionally, impacts from heavy equipment use outside aquatic management zones may create indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to prevent such adverse impacts to wetlands and populations of this species. For instance, establishing aquatic management zones and restricting activities that are most likely to affect sensitive riparian and aquatic areas would minimize on-site soil movement in these sensitive areas, while maintaining or improving water quality and other water and riparian-dependent values (measure SOP-6). In addition, landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites, where possible, so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Furthermore, skid trails, landings, staging areas, yarding decks, and logging decks would be located outside of aquatic management zones and wet meadows (measure Veg-9). Skidding across intermittent and ephemeral channels would only occur at designated locations (measure Veg-10) and the number of crossings would be minimized to the extent practicable (measure Water-5). Hand thinning methods are preferred within aquatic management zones and wet meadows; and no trees that are stabilizing or maintaining the integrity of any seep, spring, or perennial, intermittent, or ephemeral drainage would be cut (measures Water-2, Water-4, and Veg-11). While hand thinning may also affect Chapline's columbine in the short term, less soil compaction and erosion, loss of vegetative cover, and loss of individuals or populations of this species would occur and treated sites are expected to recover more quickly than areas treated mechanically.

Long-term indirect effects of tree thinning actions near spring, wetland, and riparian habitats may be beneficial to Chapline's columbine since tree thinning would improve watershed health and potentially the hydrologic function of springs and wetlands adjacent to treatment areas. Furthermore, suitable habitat for Chapline's columbine generally consists of open areas with minimal tree canopy cover, so long-term indirect effects of vegetation thinning actions may be beneficial to the species if a population occurs within a treatment area, since tree thinning could create more suitable open understory habitat for the species. In addition, vegetation thinning treatments may also benefit Chapline's columbine by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Short-term effects of prescribed fire on riparian, seep, and spring wetland habitats of Chapline's columbine may directly adversely impact individual plants or populations of this species; however, suitable habitat for this species is in open rocky areas that would not support high fuel loads for moderate or high-severity fire. Equipment/vehicle staging areas, and fuel used for ignition devices would be located outside of occupied Chapline's columbine habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16) impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2) and within aquatic management zones (SOP-6). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on Chapline's columbine. Long-term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain open habitat. Although some individuals may be killed by fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Chapline's columbine is restricted to rocky wetland habitats. Due to the restrictions that would be in place for aquatic management zones (SOP-6), potential herbicide exposure to this species is unlikely. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3).In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on Chapline's columbine.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2). Long-term, beneficial effects on Chapline's columbine are anticipated through improved habitat conditions. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied Chapline's columbine sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for Chapline's columbine. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

Road construction and maintenance is one of the most widespread forms of habitat modification of the past century (Trombulak and Frissell 2000). The ecological effect a road has on the surrounding environment varies greatly depending on location, design, and maintenance. Nonetheless, roads can adversely affect the surrounding environment in several ways, such as habitat fragmentation (Hansen and Clevenger 2005), alterations of the physical and chemical environment (Trombulak and Frissell 2000), and the introduction and spread of nonnative invasive species (Trombulak and Frissell 2000; Hansen and Clevenger 2005; Von der Lippe and Kowarik 2007). For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on Chapline's columbine. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant- 2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.) may benefit Chapline's columbine in the long term by stabilizing soils and improving habitat conditions.

Determination for Chapline's Columbine

The proposed action would not result in any direct effects on Chapline's columbine, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species. Additionally, standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** Chapline's columbine. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for Chapline's columbine.

Tall Milkvetch (Astragalus altus)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of insects and disease, high fuel loading, and climate change, and over time may cause adverse environmental impacts to this species in the form of high-severity wildfire, loss of native vegetation, and increased soil erosion and increases in nonnative invasive plants following catastrophic wildfire.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Reducing vegetation and changing stand composition could cause impacts for species associated with closed-canopy forest. The primary potential adverse project effects on native plants are soil surface disturbances caused by heavy machinery and pile burning of woody materials resulting from tree thinning. Any activities that alter local hydrological processes may adversely affect plants associated with springs, wetlands, and riparian areas. However, resource protection measures outlined in Chapter 2 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term, minor impacts to tall milkvetch. However, the species is largely found in open habitats, on steep slopes, and in road cuts that are unlikely to be treated by thinning so direct impacts are unlikely. Heavy equipment use adjacent to occupied areas may create indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and may reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to minimize adverse impacts by limiting the size and duration for soil disturbance while thinning treatments and associated activities are taking place. These measures will limit the amount of soil compaction and displacement that may occur and reduce risks for the introduction and spread of nonnative invasive plants. Long-term habitat improvement is expected since tree thinning would create more suitable open understory habitat for the species.

Resource protection measures were designed to limit indirect effects on sensitive plants. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation, such as tall milkvetch (measure Veg-5). Landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites where possible so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Vegetation thinning treatments may also benefit tall milkvetch by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Prescribed fire may cause short-term adverse effects on individual plants or populations of this species. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16) impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2).

In the long term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for high-severity surface and crown fire. Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on tall milkvetch. Although some unknown individuals may be killed by prescribed fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Potential tall milkvetch exposure to herbicide is expected to be minimal. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on tall milkvetch.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2). Long-term, beneficial effects on tall milkvetch are anticipated through improved habitat conditions. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for tall milkvetch. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on tall milkvetch. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit tall milkvetch in the long term by stabilizing soils and improving habitat conditions, especially since tall milkvetch is known to grow in road cuts.

Determination for Tall Milkvetch

The proposed action would not result in any direct effects on tall milkvetch, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). Additionally, standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** tall milkvetch. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for tall milkvetch.

Wooton's Hawthorn (Crataegus wootoniana)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of climate change-induced drought and soil water deficits, and over time may cause adverse environmental impacts to this species in the form of reduced water suppling the riparian, seep, and spring habitats to which this species is restricted. High-severity wildfire, loss of native vegetation, and increased soil erosion, catastrophic flooding, and increases in nonnative invasive plants following catastrophic wildfire also would adversely affect hydrology and habitats for this species.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Any activities that alter local hydrological processes may adversely affect this species as it is associated with wet rocky riparian areas and limestone seeps and springs. However, resource protection measures outlined in Chapter 2 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term, minor impacts to Wooton's hawthorn. Heavy equipment use adjacent to occupied areas may create indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2) have been designed to minimize adverse impacts by limiting the size and duration for soil disturbance while thinning treatments and associated activities are taking place. These measures would limit the amount of soil compaction and displacement that may occur and reduce risks for the introduction and spread of nonnative invasive plants. Long-term habitat improvement is expected since tree thinning would create more suitable open understory habitat for the species.

Resource protection measures were designed to limit indirect effects on sensitive plants. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation, such as Wooton's hawthorn (measure Veg-5). Landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites where possible so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Vegetation thinning treatments may also benefit Wooton's hawthorn by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Prescribed fire may cause short-term adverse effects on individual plants or populations of this species. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16), impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2).

In the long term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for high-severity surface and crown fire. Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on

Wooton's hawthorn. Although some unknown individuals may be killed by prescribed fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Potential Wooton's hawthorn exposure to herbicide is expected to be minimal. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on Wooton's hawthorn.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2). Long-term, beneficial effects on Wooton's hawthorn are anticipated through improved habitat conditions. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for Wooton's hawthorn. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on Wooton's hawthorn. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit Wooton's hawthorn in the long term by stabilizing soils and improving habitat conditions in canyon bottoms.

Determination for Wooton's Hawthorn

The proposed action would not result in any direct effects on Wooton's hawthorn, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). Standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** Wooton's hawthorn. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for Wooton's hawthorn.

Yellow Lady's-slipper (Cypripedium parviflorum var. *pubescens)*

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations;

nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of climate change-induced drought and soil water deficits, and over time may cause adverse environmental impacts to this species in the form of reduced water suppling the riparian, seep, and spring habitats to which this species is restricted. High-severity wildfire, loss of native vegetation, and increased soil erosion, catastrophic flooding, and increases in nonnative invasive plants following catastrophic wildfire also would adversely affect hydrology and habitats for this species.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Any activities that alter local hydrological processes may adversely affect this species as it is associated with bogs, meadows, stream banks, drainages, seepages, and damp woods. However, resource protection measures outlined in Chapter 2 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term minor impacts to yellow lady's-slipper. Mechanical treatments would not occur within the aquatic management zones (including riparian or wetland environments) that are associated with this species. However, heavy equipment use adjacent to these zones could result in removal or damage to individuals or populations that may occur outside of the designated aquatic management zones. Additionally, impacts from heavy equipment use outside aquatic management zones may create indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to prevent such adverse impacts to wetlands and populations of this species. For instance, establishing aquatic management zones and restricting activities that are most likely to affect sensitive riparian and aquatic areas would minimize on- site soil movement in these sensitive areas, while maintaining or improving water quality and other water and riparian-dependent values (measure SOP-6). In addition, landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites, where possible, so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Furthermore, skid trails, landings, staging areas, yarding decks, and logging decks would be located outside of aquatic management zones and wet meadows (measure Veg-9). Skidding across intermittent and ephemeral channels would only occur at designated locations (measure Veg-10) and the number of crossings would be minimized to the extent practicable (measure Water-5).

Hand thinning methods are preferred within aquatic management zones and wet meadows; and no trees that are stabilizing or maintaining the integrity of any seep, spring, or perennial, intermittent, or ephemeral drainage would be cut (measures Water-2, Water-4, and Veg-11). While hand thinning may also affect yellow lady's-slipper in the short term, less soil compaction and erosion, loss of vegetative cover, and loss of individuals or populations of this species would occur and treated sites are expected to recover more quickly than areas treated mechanically.

Long-term indirect effects of tree thinning actions near spring, wetland, and riparian habitats may be beneficial to yellow lady's-slipper since tree thinning would improve watershed health and potentially the hydrologic function of springs and wetlands adjacent to treatment areas. Furthermore, suitable habitat for yellow lady's-slipper generally consists of open areas with minimal tree canopy cover, so long-term indirect effects of vegetation thinning actions may be beneficial to the species if a population occurs within a treatment area, since tree thinning could create more suitable open understory habitat for the species. In addition, vegetation thinning treatments may also benefit yellow lady's-slipper by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Short-term effects of prescribed fire on riparian, seep, and spring wetland habitats of yellow lady's slipper may directly adversely impact individual plants or populations of this species; however, suitable habitat for this species is in open rocky areas that would not support high fuel loads for moderate or high-severity fire. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied yellow lady's slipper habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16), impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2) and within aquatic management zones (SOP-6). Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on yellow lady's slipper. Long-term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain open habitat for the species. Although some individuals may be killed by fire, overall population trends should be positive following low- to moderate-severity fires.

Effects from Targeted Herbicide Applications

Yellow lady's slipper is restricted to rocky wetland habitats. Due to the restrictions that would be in place for aquatic management zones (SOP-6), potential herbicide exposure to this species is unlikely. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3).
In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on yellow lady's slipper.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2, Section 2.2.5). Long- term, beneficial effects on yellow lady's slipper are anticipated through improved habitat conditions. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for yellow lady's slipper. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on yellow lady's slipper. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit yellow lady's slipper in the long term by stabilizing soils and improving habitat conditions.

Determination for Yellow Lady's Slipper

The proposed action would not result in any direct effects on yellow lady's slipper, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). In addition, all wetland, riparian, and spring habitats would be avoided by project actions, thus excluding wetland obligate species from potential adverse project actions. Post-action monitoring of obligate wetland plant species would be needed to ensure that they surface hydrology and individuals were not adversely affected by project actions. Therefore, the proposed action may result indirectly in a decrease of suitable habitat of some sensitive plant species through the reduction of canopy cover from timber harvest activities and prescribed fire. Standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** yellow lady's slipper. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for yellow lady's slipper.

Villard (Sneed's) Pincushion Cactus (Escobaria villardii / Escobaria sneedii)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline and the threat of uncharacteristic wildfire would persist.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. The proposed action could result in short-term and long-term adverse effects on the Villard pincushion cactus; however, most of these potential adverse effects would be mitigated through the application of resource protection measures. For instance, prior to implementation, surveys would be conducted for Villard pincushion cactus where suitable habitat exists (measure SOP-4). In addition, prior to scheduling implementation activities, a qualified Forest Service botanist or designated representative would be consulted to ensure resource protection measures are applied appropriately (measure Plant-1). This consultation would be coordinated through interdisciplinary development of an annual treatment plan (measureSOP-1) and annual pre-operations briefing to ensure all appropriate resource protection measures are followed (measure SOP-2).

The proposed action could result in long-term beneficial effects on the species because the restoration treatments may reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area by reducing the density of forest canopy cover. By creating more suitable habitat, the proposed action may allow for expansion of the species into previously unoccupied areas.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term, minor impacts to Villard pincushion cactus. However, the species is largely found in open habitats with minimal tree canopy that are unlikely to be treated by thinning so direct impacts are unlikely. Heavy equipment use adjacent to occupied areas may create indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to minimize adverse impacts by limiting the size and duration for soil disturbance while thinning treatments and associated activities are taking place. These measures will limit the amount of soil compaction and displacement that may occur and reduce risks for the introduction and spread of nonnative invasive plants. Long-term habitat improvement is expected since tree thinning would create more suitable open habitat for the species.

Resource protection measures were designed to limit indirect effects on sensitive plants. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation, such as Villard pincushion cactus (measure Veg-5). Landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites where possible so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Vegetation thinning treatments may also benefit Villard pincushion cactus by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Prescribed fire may cause short-term adverse effects on individual plants or populations of this species. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16), impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2).

In the long term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for high-severity surface and crown fire. Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on Villard pincushion cactus. Although some unknown individuals may be killed by prescribed fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Potential Villard pincushion cactus exposure to herbicide is expected to be minimal. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on Villard pincushion cactus.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2). Long-term, beneficial effects on Villard pincushion cactus are anticipated through improved habitat conditions. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for Villard pincushion cactus. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on Villard pincushion cactus. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit Villard pincushion cactus in the long term by stabilizing soils and improving habitat conditions.

Determination for Villard Pincushion Cactus

The proposed action would not result in any direct effects on Villard pincushion cactus, because pre- action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures (measure SOP-4). Additionally, standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** Villard pincushion cactus. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for Villard pincushion cactus.

Wooton's Alumroot (Heuchera wootonii)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of insects and disease, high fuel loading, and climate change, and over time may cause adverse environmental impacts to this species in the form of high-severity wildfire, loss of native vegetation, and increased soil erosion and increases in nonnative invasive plants following catastrophic wildfire.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Reducing vegetation and changing stand composition could cause impacts for species associated with closed-canopy forest. The primary potential adverse project effects on native plants are soil surface disturbances caused by heavy machinery and pile burning of woody materials resulting from tree thinning. Any activities that alter local hydrological processes may adversely affect plants associated with springs, wetlands, and riparian areas. However, resource protection measures outlined in Chapter 2 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term, minor impacts to Wooton's alumroot. Heavy equipment use within and adjacent to occupied areas may create direct effects through crushing or trampling individuals and indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to minimize adverse impacts by limiting the size and duration for soil disturbance while thinning treatments and associated activities are taking place. These measures would limit the amount of soil compaction and displacement that may occur and reduce risks for the introduction and spread of nonnative invasive plants. Long-term habitat improvement is expected since tree thinning would create more suitable open understory habitat for the species.

Resource protection measures were designed to limit indirect effects on sensitive plants. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation, such as Wooton's alumroot (measure Veg-5). Landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites where possible so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Vegetation thinning treatments may also benefit Wooton's alumroot by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Prescribed fire may cause short-term adverse effects on individual plants or populations of this species. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16), impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2).

In the long term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for high-severity surface and crown fire. Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on Wooton's alumroot. Although some unknown individuals may be killed by prescribed fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Potential Wooton's alumroot exposure to herbicide is expected to be minimal. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on Wooton's alumroot.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2). Long-term, beneficial effects on Wooton's alumroot are anticipated through improved habitat conditions. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for Wooton’s alumroot. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on Wooton’s alumroot. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit Wooton's alumroot in the long term by stabilizing soils and improving habitat conditions.

Determination for Wooton's Alumroot

The proposed action would not result in any direct effects on Wooton's alumroot, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). However, the proposed action may result indirectly in a decrease of suitable habitat of some sensitive plant species through the reduction of canopy cover from timber harvest activities and prescribed fire. Standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** Wooton's alumroot. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for Wooton's alumroot.

Arizona Crested Coralroot (Hexalectris arizonica)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of insects and disease, high fuel loading, and climate change, and over time may cause adverse environmental impacts to this species in the form of high-severity wildfire, loss of native vegetation, and increased soil erosion and increases in nonnative invasive plants following catastrophic wildfire.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. The proposed action could result in short-term and long-term adverse effects on the Arizona crested coralroot; however, most of these potential adverse effects would be mitigated through the application of resource protection measures. For instance, prior to implementation, surveys would be conducted for Arizona crested coralroot where suitable habitat exists (measure SOP-4). In addition, prior to scheduling implementation activities, a qualified Forest Service botanist or designated representative would be consulted to ensure resource protection measures are applied appropriately (measure Plant-1). This consultation would be coordinated through interdisciplinary development of an annual treatment plan (measure SOP-1) and annual pre-operations briefing to ensure all appropriate resource protection measures are followed (measure SOP-2).

The proposed action could result in long-term beneficial effects on the species because the restoration treatments may reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area by reducing the density of forest canopy cover. By creating more suitable habitat, the proposed action may allow for expansion of the species into previously unoccupied areas.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term, minor impacts to Arizona crested coralroot. Heavy equipment use within and adjacent to occupied areas may create direct effects through trampling individuals or indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to minimize adverse impacts by limiting the size and duration for soil disturbance while thinning treatments and associated activities are taking place. These measures would limit the amount of soil compaction and displacement that may occur and reduce risks for the introduction and spread of nonnative invasive plants.

Resource protection measures were designed to limit indirect effects on sensitive plants. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation, such as Arizona crested coralroot (measure Veg-5). Landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites where possible so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Vegetation thinning treatments may also benefit Arizona crested coralroot by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Prescribed fire may cause short-term adverse effects on individual plants or populations of this species. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16), impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2).

In the long term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for high-severity surface and crown fire. Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on Arizona crested coralroot. Although some unknown individuals may be killed by prescribed fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Potential Arizona crested coralroot exposure to herbicide is expected to be minimal. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on Arizona crested coralroot.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2). Long-term, beneficial effects on Arizona crested coralroot are anticipated through improved habitat conditions. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for Arizona crested coralroot sites. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on Arizona crested coralroot. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit Arizona crested coralroot in the long term by stabilizing soils and improving habitat conditions.

Determination for Arizona Crested Coralroot

The proposed action would not result in any direct effects on Arizona crested coralroot, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). Additionally, standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** Arizona crested coralroot. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for Arizona crested coralroot.

Wood Lily (Lilium philadelphicum)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of insects and disease, high fuel loading, and climate change, and over time may cause adverse environmental impacts to this species in the form of high-severity wildfire, loss of native vegetation, and increased soil erosion and increases in nonnative invasive plants following catastrophic wildfire.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Reducing vegetation and changing stand composition could cause impacts for species associated with closed-canopy forest. The primary potential adverse project effects on native plants are soil surface disturbances caused by heavy machinery and pile burning of woody materials resulting from tree thinning. Any activities that alter local hydrological processes may adversely affect plants associated with springs, wetlands, and riparian areas. However, resource protection measures outlined in Chapter 2 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term minor impacts to wood lily. Mechanical treatments would not occur within the aquatic management zones (including riparian or wetland environments) that are associated with this species. However, heavy equipment use adjacent to these zones could result in removal or damage to individuals or populations that may occur outside of the designated aquatic management zones. Additionally, impacts from heavy equipment use outside aquatic management zones may create indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to prevent such adverse impacts to wetlands and populations of this species. For instance, establishing aquatic management zones and restricting activities that are most likely to affect sensitive riparian and aquatic areas would minimize on-site soil movement in these sensitive areas, while maintaining or improving water quality and other water and riparian-dependent values (measure SOP-6). In addition, landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites, where possible, so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Furthermore, skid trails, landings, staging areas, yarding decks, and logging decks would be located outside of aquatic management zones and wet meadows (measure Veg-9). Skidding across intermittent and ephemeral channels would only occur at designated locations (measure Veg-10) and the number of crossings would be minimized to the extent practicable (measure Water-5). Hand thinning methods are preferred within aquatic management zones and wet meadows; and no trees that are stabilizing or maintaining the integrity of any seep, spring, or perennial, intermittent, or ephemeral drainage would be cut (measures Water-2, Water-4, and Veg-11). While hand thinning may also affect wood lily in the short term, less soil compaction and erosion, loss of vegetative cover, and loss of individuals or populations of this species would occur and treated sites are expected to recover more quickly than areas treated mechanically.

Long-term indirect effects of tree thinning actions near spring, wetland, and riparian habitats may be beneficial to wood lily since tree thinning would improve watershed health and potentially the hydrologic function of springs and wetlands adjacent to treatment areas. Furthermore, suitable habitat for wood lily generally consists of open areas with minimal tree canopy cover, so long-term indirect effects of vegetation thinning actions may be beneficial to the species if a population occurs within a treatment area, since tree thinning could create more suitable open understory habitat for the species. In addition, vegetation thinning treatments may also benefit wood lily by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Short-term effects of prescribed fire on riparian, seep, and spring wetland habitats of wood lily may directly adversely impact individual plants or populations of this species; however, suitable habitat for this species is in wetlands and wet meadows associated with open, mature coniferous forests that would not support high fuel loads for moderate- or high-severity fire. Equipment/vehicle staging areas, and fuel used for ignition devices would be located outside of occupied wood lily habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16), impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2) and within aquatic management zones (SOP-6). Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on wood lily. Long-term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain open habitat for the species. Although some individuals may be killed by fire, overall population trends should be positive following low- to moderate-severity fires.

Effects from Targeted Herbicide Applications

Wood lily is restricted to wetland habitats. Due to the restrictions that would be in place for aquatic management zones (SOP-6), potential herbicide exposure to this species is unlikely. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on wood lily.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2, Section 2.2.5). Long- term, beneficial effects on wood lily are anticipated through improved habitat conditions. Long-term indirect effects of site rehabilitation, and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for wood lily. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on wood lily. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used, and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit wood lily in the long term by stabilizing soils and improving habitat conditions.

Determination for the Wood Lily

The proposed action would not result in any direct effects on the wood lily, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). Additionally, post-action monitoring would be employed to ensure that sensitive plant species remain unaffected by project actions. Additionally, standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat** for the wood lily. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for the wood lily.

Ladies' Tresses (Green Medusa Orchid) (Microthelys rubrocallosa)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of insects and disease, high fuel loading, and climate change, and over time may cause adverse environmental impacts to this species in the form of high-severity wildfire, loss of native vegetation, and increased soil erosion and increases in nonnative invasive plants following catastrophic wildfire.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Reducing vegetation and changing stand composition could cause impacts for species associated with closed-canopy forest. The primary potential adverse project effects on native plants are soil surface disturbances caused by heavy machinery and pile burning of woody materials resulting from tree thinning. Any activities that alter local hydrological processes may adversely affect plants associated with springs, wetlands, and riparian areas. However, resource protection measures outlined in Chapter 2 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning
Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term, minor impacts to ladies' tresses. Heavy equipment use within and adjacent to occupied areas may create direct effects through trampling individuals or indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to minimize adverse impacts by limiting the size and duration for soil disturbance while thinning treatments and associated activities are taking place. These measures would limit the amount of soil compaction and displacement that may occur and reduce risks for the introduction and spread of nonnative invasive plants.

Resource protection measures were designed to limit indirect effects on sensitive plants. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation, such as ladies' tresses (measure Veg-5). Landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites where possible so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Vegetation thinning treatments may also benefit ladies' tresses by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire
Prescribed fire may cause short-term adverse effects on individual plants or populations of this species. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16) impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2).

In the long term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for high-severity surface and crown fire. Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on ladies' tresses. Although some unknown individuals may be killed by prescribed fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Potential ladies' tresses exposure to herbicide is expected to be minimal. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on ladies' tresses.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2, Section 2.2.5). Long-term, beneficial effects on ladies' tresses are anticipated through improved habitat conditions. Long-term indirect effects of site rehabilitation, and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for ladies' tresses. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on ladies' tresses. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit ladies' tresses in the long term by stabilizing soils and improving habitat conditions.

Determination for Ladies' Tresses

The proposed action would not result in any direct effects on ladies' tresses, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). However, the proposed action may result indirectly in a decrease of suitable habitat of some sensitive plant species through the reduction of canopy cover from timber harvest activities and prescribed fire. Standard operating procedures and resource protection measures discussed above are in place to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** ladies' tresses. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for ladies' tresses.

Alamo Beardtongue (Penstemon alamosensis)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of climate change-induced drought and soil water deficits, and over time may cause adverse environmental impacts to this species in the form of reduced water suppling the riparian, seep, and spring habitats to which this species is restricted. High-severity wildfire, loss of native vegetation, and increased soil erosion, catastrophic flooding and increases in nonnative invasive plants following catastrophic wildfire also would adversely affect hydrology and habitats for this species.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Any activities that alter local hydrological processes may adversely affect this species as it is associated with wet rocky riparian areas and limestone seeps and springs. However, resource protection measures outlined in Chapter 2 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term, minor impacts to Alamo beardtongue. Heavy equipment use within and adjacent to occupied areas may create direct effects through trampling individuals or indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat. However, resource protection measures (see Chapter 2, Section 2.2.5) have been designed to minimize adverse impacts by limiting the size and duration for soil disturbance while thinning treatments and associated activities are taking place. These measures would limit the amount of soil compaction and displacement that may occur and reduce risks for the introduction and spread of nonnative invasive plants.

Resource protection measures were designed to limit indirect effects on sensitive plants. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation, such as Alamo beardtongue (measure Veg-5). Landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites where possible so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Vegetation thinning treatments may also benefit Alamo beardtongue by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Prescribed fire may cause short-term adverse effects on individual plants or populations of this species. However, suitable habitat for this species consists of rocky, limestone bottoms and cool-aspect slopes of canyons along the western slopes of the Sacramento Mountains that typically would not support moderate- or high-severity fire. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16) impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2).

In the long term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for high-severity surface and crown fire. Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on Alamo beardtongue. Although some unknown individuals may be killed by prescribed fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Potential Alamo beardtongue exposure to herbicide is expected to be minimal. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on Alamo beardtongue.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2). Long-term, beneficial effects on Alamo beardtongue are anticipated through improved habitat conditions.
Long- term indirect effects of site rehabilitation, and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for Alamo beardtongue. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17). In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on Alamo beardtongue. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit Alamo beardtongue in the long term by stabilizing soils and improving habitat conditions.

Determination for Alamo Beardtongue

The proposed action would not result in any direct effects on Alamo beardtongue because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). Additionally, the proposed action may result indirectly in a decrease of suitable habitat of some sensitive plant species through the reduction of canopy cover from timber harvest activities and prescribed fire. Standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** Los Alamos beardtongue. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for Los Alamos beardtongue.

Cloudcroft Scorpionweed (Phacelia cloudcroftensis)

Alternative 1 – No Action

There would be no direct, indirect, or cumulative impacts to this species from project actions under this alternative, because there would be no mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; nor the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Under the no action alternative, forest health conditions would continue to decline from the ongoing effects of insects and disease, high fuel loading, and climate change, and over time may cause adverse environmental impacts to this species in the form of high-severity wildfire, loss of native vegetation, and increased soil erosion and increases in nonnative invasive plants following catastrophic wildfire.

Alternative 2 – Proposed Action

The proposed action would include mechanical tree thinning treatments; prescribed fire; site rehabilitation and tree planting; watershed improvement and erosion control; water developments; improvement of recreation sites; development of interpretive sites; road construction, reconstruction, maintenance, and rehabilitation; construction of timber processing areas or special use authorizations; along with the potential environmental disturbances associated with such activities, including the spread of nonnative invasive plant species. Reducing vegetation and changing stand composition could cause impacts for species associated with closed-canopy forest. The primary potential adverse project effects on native plants are soil surface disturbances caused by heavy machinery and pile burning of woody materials resulting from tree thinning. Any activities that alter local hydrological processes may adversely affect plants associated with springs, wetlands, and riparian areas. However, resource protection measures outlined in Chapter 2 to protect rare plant species were developed to prevent or minimize adverse impacts to the species that could occur during project implementation including measures that would prevent the introduction and establishment of nonnative invasive plants.

Effects from Vegetation Thinning

Vegetation treatments (e.g., free thinning, thin from below, and matrix thinning) may cause short-term minor impacts to Cloudcroft scorpionweed. Mechanical treatments would not occur within the aquatic management zones (including arroyos) and in road cuts that are unlikely to be treated by thinning so direct impacts are unlikely. However, heavy equipment use adjacent to these areas could result in removal or damage to individuals or populations that may occur outside of the designated aquatic management zones or road cuts. Additionally, impacts from heavy equipment use outside aquatic management zones or road cuts may create indirect effects through soil compaction, reduced amounts of residual biomass and associated plant litter, and increased soil erosion. Soil erosion and compaction would result in changes to the soil structure, organic content, and soil moisture, and would reduce the quality of suitable habitat.

Resource protection measures were designed to limit indirect effects on sensitive plants. For example, in areas where mastication may be used as a tool for vegetation thinning, the accumulation of shredded wood would be limited to allow for growth of grasses and other understory vegetation, such as Cloudcroft scorpionweed (measure Veg-5). Landings, skid trails, temporary roads, and slash piles would be located in suitable sites to avoid, minimize, or mitigate the potential impacts to sensitive species (measure SOP-7). Staging areas, turnaround sites, and landings would be kept as small as possible to minimize bare soil (measure SOP-8), and areas such as these would be monitored for the presence of nonnative invasive plant species prior to and after ground-disturbing activities are implemented (measures SOP-17 and SOP-18). Slash piles would be placed on previously disturbed sites where possible so as to avoid severe disturbance to previously undisturbed sites; and slash would be machine piled in such a way as to leave topsoil in place (measure Veg-16). Establishing aquatic management zones and restricting activities that are most likely to affect sensitive riparian and aquatic areas would minimize on-site soil movement in these sensitive areas, while maintaining or improving water quality and other water and riparian-dependent values (measure SOP-6). While hand thinning may also affect Cloudcroft scorpionweed in the short term, less soil compaction and erosion, loss of vegetative cover, and loss of individuals or populations of this species would occur and treated sites are expected to recover more quickly than areas treated mechanically. Vegetation thinning treatments may also benefit this species by reducing the risk of high-intensity wildfire by decreasing the density of forest canopy cover.

Effects from the Use of Fire

Prescribed fire may cause short-term adverse effects on individual plants or populations of this species. Equipment and vehicle staging areas, and fuel used for ignition devices would be located outside of occupied sensitive plant habitat. Fuel and ignition devices would not be used in occupied habitat and slash would not be piled or ignited in occupied habitat (measure Rx-10). Fire is allowed and expected to creep into these zones; however, in areas treated with prescribed fire, fire prescriptions would be designed so fire intensity is minimized and soil health and productivity as well as duff and residual vegetative cover are maintained overall (measure Rx-8). Because slash would be piled and burned on previously disturbed sites whenever possible (measure Veg-16) impacts to plants and soils in undisturbed areas would be reduced. Further, buffers and other measures for prescribed fire activities may be applied as determined by a Forest Service botanist or designated representative where known sensitive plant populations are located to minimize adverse impacts (measure Plant-2).

In the long term, prescribed fire would be beneficial to this species, because frequent surface fire would maintain habitat conditions for the species and reduce the risk of high-intensity surface fire and the potential for high-severity surface and crown fire. Due to these and other resource protection measures previously mentioned, it is unlikely that prescribed fire would result in any long-term adverse effects on Cloudcroft scorpionweed. Although some unknown individuals may be killed by prescribed fire, overall population trends should be positive following low- to moderate-severity surface fires.

Effects from Targeted Herbicide Applications

Potential Cloudcroft scorpionweed exposure to herbicide is expected to be minimal. Herbicides would be applied to juniper and oak resprouts using targeted methods. The use of resource protection measures relative to applications procedures would limit herbicides from dispersing to suitable habitat areas. For instance, herbicides would only be applied within prescribed environmental conditions as specified in the herbicide label instructions (measure Herbicide-1); and applicators would ensure that application rates would not exceed herbicide label instructions (measure Herbicide-3). In addition, areas used for mixing herbicides and cleaning equipment would be located where spillage would not run into surface waters or result in groundwater contamination (measure Herbicide-6). Furthermore, herbicide use would be restricted within 25 feet of any known occurrence of sensitive plants (measure Plant-2). Even though herbicides were designed to inhibit or destroy plants, the amount and application methods used to apply herbicide should be localized enough that there would be minor effects on Cloudcroft scorpionweed.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, interpretive sites, special use authorizations, and road management may be necessary to achieve desired conditions. Impacts from these activities are expected to be minor because these activities would generally be small in scale and contribute to long-term habitat improvement. Additionally, impacts would be minimized due to resource protection measures designed to minimize impacts to individuals and habitats (see Chapter 2, Section 2.2.5). Long- term, beneficial effects on Cloudcroft scorpionweed are anticipated through improved habitat conditions. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to these species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of this species habitats to the adverse effects of climate change-induced drought. Other activities such as recreation site rehabilitation would repair damage to soils and vegetation created by heavy use, thereby improving habitat conditions; while interpretive sites may serve to educate the public about sensitive resources, which may result in less intensive use. Likewise, water developments could be used to encourage ungulates to use areas that are outside of areas with sensitive resources, such as occupied sites, and areas that are underutilized for forage.

Effects from Special Use Authorizations

Some sites within the project area may be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerators, etc., which may facilitate more utilization of forest resources and increase transportation efficiencies. These designated sites may be located anywhere within the 140,000-acre project area; however, they would be located more than 25 feet from populations of sensitive plant species as described in the proposed action. Surveys for sensitive plant species would be completed where suitable habitat exists unless surveys are not required as determined by a qualified Forest Service botanist or designated representative (measure SOP-4). As a result, no direct adverse effects are anticipated for Cloudcroft scorpionweed. However, due to the potential size of the sites (greater than 5 acres), duration of use (continuously for 10 to 20 years), and the disturbance intensity associated with operations at these processing sites (drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, and scaling and weighing logs, and creating poles from suitably sized logs), creation and use of these sites may result in long-term indirect adverse effects. Equipment used to conduct operations, such as front-end loaders, log loaders and chippers, timber processors, planers, conveyors, log sorting bunks, mobile incinerators, electric motors, and gas or diesel generators may result in soil compaction and erosion due to prolonged use at the site. Soil compaction and erosion could result in changes to the soil structure, organic content, and soil moisture, which would reduce the quality of suitable habitat. Furthermore, prolonged use of the site and use of the equipment described above may increase the risk of introduction and spread of nonnative invasive plant species. Nonnative invasive plant species have been known to alter suitable habitat for native plant species by altering disturbance regimes, nutrient cycles, and hydrologic cycles. However, in an attempt to prevent the introduction and spread of nonnative invasive plants, surveys for nonnative invasive plants would be conducted prior to initial ground-disturbing activities and known infestations of nonnative invasive plants would be avoided during project implementation, when possible (measure SOP-17). Vehicles, including off-highway vehicles, machinery, tools, and other equipment used for implementation would be cleaned of seeds, soil, vegetative matter, and other debris that could contain or hold seeds, prior to entering the designated area (measure SOP-17).

In addition, disturbed areas, such as these, would be monitored for nonnative invasive plants after project activities and site rehabilitation have been completed (measure SOP-18).

Effects from Road Management

For this project, road management activities such as road construction, reconstruction, relocation, maintenance, and rehabilitation would occur on approximately 240 miles. In addition, up to 125 miles of temporary and system roads would be constructed to support project implementation. These actions are expected to have both direct and indirect, minor, short-term adverse impacts on Cloudcroft scorpionweed. However, resource protection measures have been developed to minimize potential impacts from these activities. Previously disturbed areas would be used and roads would be located outside of aquatic management zones whenever feasible (Road-5) to minimize soil disturbance and compaction as well as the loss of ground cover. At stream crossings, a buffer of 25 feet may be applied around known sensitive plant populations (Plant-2) when constructing or rerouting roads. Rehabilitation of temporary roads (Road-16) near sensitive plant populations would reduce long-term indirect impacts. Some road maintenance activities, such as constructing and/or improving drainage features (grade dips, lead out ditches, roadside ditches, drainage crossings, and culverts) and installing erosion control treatments (riprap or geotextile materials, creating sediment basins, etc.), may benefit Cloudcroft scorpionweed in the long term by stabilizing soils and improving habitat conditions, since they have been found growing along roadcuts and other disturbed areas.

Determination for Cloudcroft Scorpionweed

The proposed action would not result in any direct effects on Cloudcroft scorpionweed, because pre-action presence/absence surveys would be conducted by the Forest Service botanist to identify and take protection measures for all of these sensitive plant species (measure SOP-4). The proposed action may result indirectly in a decrease of suitable habitat of some sensitive plant species through the reduction of canopy cover from timber harvest activities and prescribed fire. Standard operating procedures and resource protection measures to prevent the introduction and spread of nonnative invasive plant species would be implemented by the proposed action.

The proposed action **may impact individuals or habitat for** Cloudcroft scorpionweed. However, the cumulative impacts of the direct and indirect effects of these proposed actions, combined with the effects of past, present, and reasonably foreseeable future projects, would be compensated for by project planning and best management practices (resource protection measures) such that they are **not likely to cause a trend toward federal listing or a loss of viability** for Cloudcroft scorpionweed.

Cumulative Effects

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 cumulative impacts on rare plants. Restoration activities would occur on adjacent public lands, including the Rio Peñasco Two Project, Jim Lewis Fuel Reduction Project, Two Goats Restoration Project, and Westside Watershed Restoration Project restoration treatments, and would also increase ecosystem resilience in the Sacramento Mountains. Combined, these projects would treat up to approximately 94,000 acres over the next decade. Mechanical treatments and other restoration activities on the adjacent state lands and tribal lands would work to improve the forest’s resiliency in a changing climate; thereby resulting in long-term benefits to rare plants.

Other projects may have adverse impacts to the species, depending on resource protection measures of those other projects that are designed to protect rare plant species. The primary management action that would have potential adverse cumulative effects on these rare plant species is livestock grazing.

Domestic livestock grazing is a serious threat to the species due to trampling and consumption of individual plants by livestock, trampling and compaction of wetland soils that damages habitat for the species, and livestock and livestock management (supplemental feeding and transportation of animals) introducing nonnative invasive plant species.

3.3.4 Forest Plan Amendments

The following amendment components would have the potential to affect rare plant species and their habitats:

- Incorporating new or modified guidance for the management of northern goshawk habitat;
- Incorporating new or modified U.S. Fish and Wildlife Service direction, including the use of a broader range of treatment options over extended time frames in Mexican spotted owl habitat;
- Updating management direction for essential habitat for federally listed species;
- Using ground-based, mechanized equipment on slopes greater than 40 percent; and
- Using herbicides to treat juniper and oak resprouts within municipal watersheds so this restoration tool could be used as appropriate across the entire project area.

The amendment components that would allow ground-based mechanized equipment to be used on slopes greater than 40 percent and allow forest restoration treatments to occur in Mexican spotted owl protected activity centers, northern goshawk habitat, and treatments within other essential habitat for federally listed species would result in short-term negative impacts as well as long-term beneficial impacts to rare plant species. Allowing treatment to occur on steeper slopes would provide for landscape restoration opportunities that otherwise would not be possible. Impacts would be similar to the direct and indirect vegetation treatment effects already described for each species. However, thinning treatments that would be authorized through the amendment are expected to benefit rare plants over the long term by improving habitat conditions and reducing the risk of stand-replacing wildfire in areas that would otherwise not be treated.

The proposed changes to herbicide use direction would include authorizing treatment of juniper and oak resprouts within municipal watersheds, near areas of human habitation, or wherever needed to maintain treatments where juniper and oak species exceed desired conditions. Rare plant populations that occur in pinyon-juniper and ponderosa pine ecological response units are most likely to be affected by herbicide use because those are the habitats where oak and juniper most often occur. The impacts from implementing this amendment component would have the same length and intensity as the direct and indirect effects of herbicide use already described for each species.

Conclusion

Table 2-13 in Chapter 2 summarizes the impacts to special status plants from the no action alternative and proposed action. Table 3-19 summarizes the effect determinations provided for the proposed action, as required by the Endangered Species Act. Consultation with the U.S. Fish and Wildlife Service is currently underway; therefore, the effect determinations could be revised as agency consultation continues.

Table 3-19. Federally Listed Species with Potential to Occur in the Project Area and the Effect Determinations for Each Species

Species	Status	Known or Potential Occurrence Likely	Proposed Action Determination
Sacramento prickly poppy	Endangered	Yes	May affect, not likely to adversely affect
Sacramento Mountains thistle	Threatened	Yes	May affect, not likely to adversely affect
Kuenzler's hedgehog cactus	Endangered	Yes	May affect, not likely to adversely affect

The proposed action (Alternative 2) would have no adverse impacts to rare plant species, because project action planning and implementation would be specifically designed to avoid individuals and populations of those species. All project sites would be surveyed by a botanist to ensure that any individuals or populations of sensitive plant species are excluded from any adverse project actions. Project planning and implementation also would be designed to prevent the introduction and establishment of nonnative invasive plant species and management actions would be taken to control any nonnative plant species that may become established on project sites. The proposed action would improve environmental conditions for rare plant species by restoring ecological function to overgrown forests and woodlands and by reducing the increasing threat of uncharacteristic, stand-replacing wildfire. Both drought and high-severity wildfire are currently degrading the environmental conditions of the forests, woodlands, and associated sensitive plant species, and creating suitable disturbed habitats for nonnative invasive weed species. In contrast, the no action alternative would result in further ecological and environmental degradation of the overgrown forests and woodlands, resulting in adverse impacts to rare plant species, and enhancing the establishment and spread of undesirable nonnative invasive weed species.

3.4 Soils, Hydrology, and Watersheds

The soils, hydrology, and watershed specialist report (U.S. Forest Service 2018c) is incorporated by reference. See the report for detailed information about data sources, methodology, assumptions, and limitations.

3.4.1 Affected Environment

This section details the affected environment for soils and watershed resources that include soil condition, soil stability, water quality, and watershed functioning including stream courses (ephemeral, intermittent, perennial), water quality, upland function, and riparian area conditions within the analysis area.

Information on the existing conditions of soils, springs, and riparian areas is presented only for these resources which are found within the project area since proposed actions would likely only affect these resources that are within the project area. Information on the existing conditions of drainage areas and water quality is presented at the watershed scale since proposed actions would potentially affect these resources at this scale.

Soil Resources

The soils found within the project area are all classified as Mollisols. Mollisol soils are characterized by a thick, dark surface horizon. These soils are among some of the most important and productive agricultural soils in the world (Brady and Weil 2002). Most soils within the project area are in satisfactory soil condition and have the ability to resist accelerated erosion due to the extensive ground cover. This can also be attributed to good soil hydrologic functioning, soil stability, and nutrient cycling.

However, large portions of the project area have closed forest stand structures that result in having a relatively high risk of crown fire that also poses a high risk of moderate or high burn severity to the watershed, including soil productivity and water quality under normal or extreme fire behavior conditions. Fires resulting in moderate or high burn severity to the soil resources pose substantial risk to life, property, soil productivity, watershed function, and downstream water quantity and quality following storm events.

One way that soil hydrologic condition was analyzed was looking at the current Fire Regime Condition Class of each ecological response unit. Soil hydrologic conditions throughout the project area are currently in good functioning condition, however, soil hydrology can be severely impacted by the occurrence of wildfire. All ecological response units are classified as FRCC 2 and 3 (see U.S. Forest Service 2018c). Ecological response units within these categories if left unmitigated can result in changes to key ecosystem components.

Soil stability is another important factor influencing soil condition, long-term productivity, and overall sustainability. To address soil stability, the erosion limitations (rated as slight, moderate, and severe) for different sources within the project area were analyzed (U.S. Forest Service 2018c). Rating categories are broken into timber limitation potential, road limit potential, and sheet and gully erosion.

The most relevant limitation for the project would be the timber harvest limitations (Figure 3-27), which can be defined as the limits to be considered when evaluating the suitability of timber harvesting by equipment use with regard to maintenance of soil productivity (Miller and others 1995). Limits relate to year-round or seasonal use of equipment as the result of climate, soil characteristics, and landform. A slight rating indicates that mechanized harvesting can be performed year-round with a low risk of soil productivity impairment. A moderate or severe rating directs the land manager to areas that require some measure of mitigation in order to avoid impairment of soil productivity. Timing of thinning operations can often be used to mitigate soil moisture problems. For example, thinning can be performed during frozen ground or dry conditions to minimize risk of soil compaction and rutting. Additionally, slope limitations can be established for different thinning treatments. Current timber harvest limitation ratings for the analysis area are shown below in Figure 3-27.

Looking at the forest canopy closure coupled with the accumulation of litter and duff, as well as dead and downed coarse woody debris, can be an indicator of the current potential to sustain nutrient cycling and a healthy soil condition. Data for the project area show that all of the ecological response units within the project boundary are currently exceeding the range for satisfactory soils and in some cases by an order of magnitude (U.S. Forest Service 2018c). While this is good for soil surface cover, heavy fuel loading does not allow for an herbaceous understory to thrive; therefore, it limits nutrient cycling as the herbaceous species growth and tree regeneration is inhibited by reduction in available light, soil temperatures, and seed access to mineral soil (Kane and others 2006). High fuel loads also can cause a high degree of soil heating due to the extended residence time needed to consume the fuels on-site, which can result in irreversible damages to the soil resource.

In addition to land management, activities such as off-road vehicle use and roads contribute the most to loss of soil productivity and impacts to water quality within the project area. This analysis has identified 360 miles of roads and 108 miles of trails throughout the total area of all the watersheds. Excess roads and trails have the potential to contribute to the long-term loss of soil productivity through erosion and sedimentation. Most roads in the area are unsurfaced, primitive dirt roads with little or no drainage control. Many roads run along canyon bottoms and cross drainage channels. The watershed condition framework analysis shows that most of the roads and trails within the project area pose a risk to water quality, soil, wildlife, and other resources.

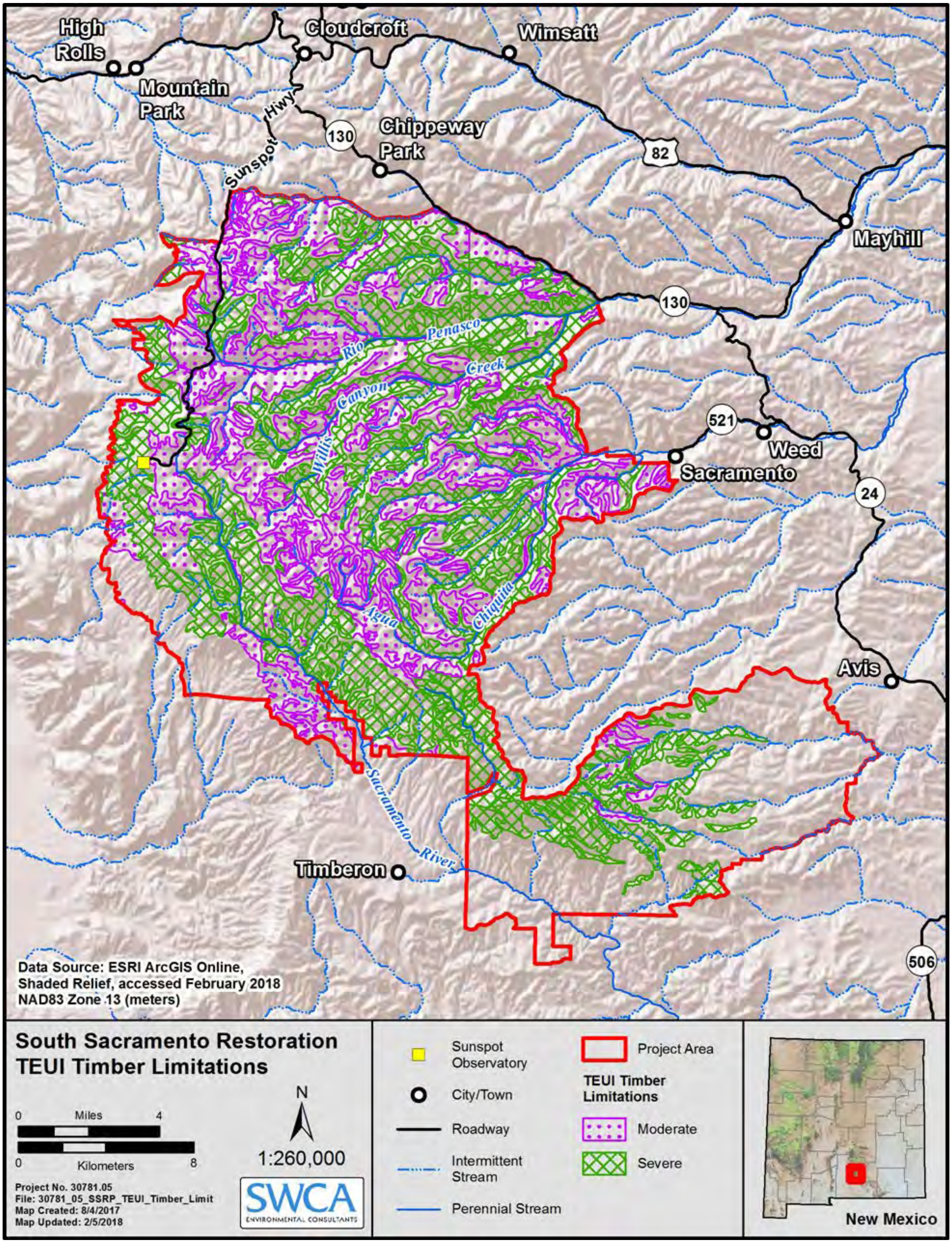

Figure 3-27. Timber harvest limitations within the South Sacramento Restoration Project Area.

Watershed Resources

Watershed resources include those features where water is found either permanently (perennially), intermittently, or ephemerally at the earth's surface including springs, ponds, wetlands, and stream channels, as well as the watersheds that contain these features. It also includes ecosystems dependent on water resources such as riparian areas (see detailed definitions in the soil, hydrology, and watershed report, U.S. Forest Service 2018c).

Watersheds

The South Sacramento Restoration Project occurs within 12 six-digit hydrologic units (sub-watersheds). These watersheds are in varying condition and health as indicated in the U.S. Forest Service watershed condition framework. This framework indicates that 11 of the watersheds are functioning at risk and one watershed is functioning impaired (Figure 3-28). The watershed condition framework also lists the indicators that are mostly directly contributing to its rating; those indicators are listed in Table 3-20 below.

It can be seen in the figure below that a majority of the severe limitations are found within stream channel corridors, where steeper slopes likely exist. In fact, maps showing the areas of severe limitations are similar across all categories including road, off-highway vehicle, sheet, and gulley erosion limitations (see Appendix B in U.S. Forest Service 2018c).

Soils rated as having a severe erosion limitation potential have a high probability of lowering site productivity when vegetation is removed or killed in a fire. In these vulnerable areas, the post-fire runoff of topsoil, soil litter and organic matter, woody material, and ash can damage the natural and human environment downstream. The majority of the assessment area, however, is in satisfactory soil loss condition, particularly in the ponderosa pine, mixed conifer, aspen, and riparian vegetation, other than where bare soil patches occur as a result of recreational, vehicular, or livestock uses. Higher-elevation forest types have the greatest amount of soil in satisfactory condition and have a higher capacity to maintain long-term soil productivity.

The erosion limitations categories within the project area are summarized in Tables 5 through 9 of the soil, hydrology, and watershed report (U.S. Forest Service 2018c). These tables show that currently very few watersheds have over 10 percent in any erosion category. In fact, the highest percentage of a watershed experiencing severe erosion is Cox Canyon-Rio Peñasco where the road limitation is severe on 12 percent of the area.

The majority of issues within the watersheds are directly related to road and trail conditions, as well as the fire effects and Fire Regime Condition Class that directly influence the water quality condition, which is also compromised in areas within the project boundaries. Many roads in the project area are inadequately engineered, are poorly located on the landscape, and are consequently in a state of disrepair. Some of these roads are located adjacent to drainage channels and are subject to erosion and sediment transport.

Current domestic and wild ungulate grazing contributes to reducing herbaceous vegetative ground cover, which contributes to accelerated soil loss, soil compaction, and declined soil productivity, especially during periods of drought. Management activities that decrease soil porosity and/or remove organic matter have been associated with declines in site productivity and functional hydrologic response (Brooks and others 2003; Gifford and Hawkins 1978; Greacen and Sands 1980; Grier and others 1989; Standish and others 1988).

The current watershed conditions do not meet the desired conditions for watershed function. Under the desired conditions watershed function would be at or moving toward satisfactory and properly functioning conditions. Watersheds would contain the proper abundance and diversity of native vegetation that would stabilize the soils, help reduce overland flow, increase infiltration rates, and increase soil water-holding capacity. This would result in a decrease of accelerated hillslope erosion, rill formation, headcut formation, and down-cutting of stream channels. However, this is currently not the case as the current wildfire danger, impaired streams, and the poor trail and road conditions limit the ability of watershed to function properly.

According to the watershed condition framework, the water quantity within the project area is currently in good condition. However, the health of the watersheds as described above results in the water quantity not meeting the desired conditions. The desired conditions are to move watersheds toward satisfactory and properly functioning conditions. Currently this is not possible given the potential for an uncharacteristic wildfire.

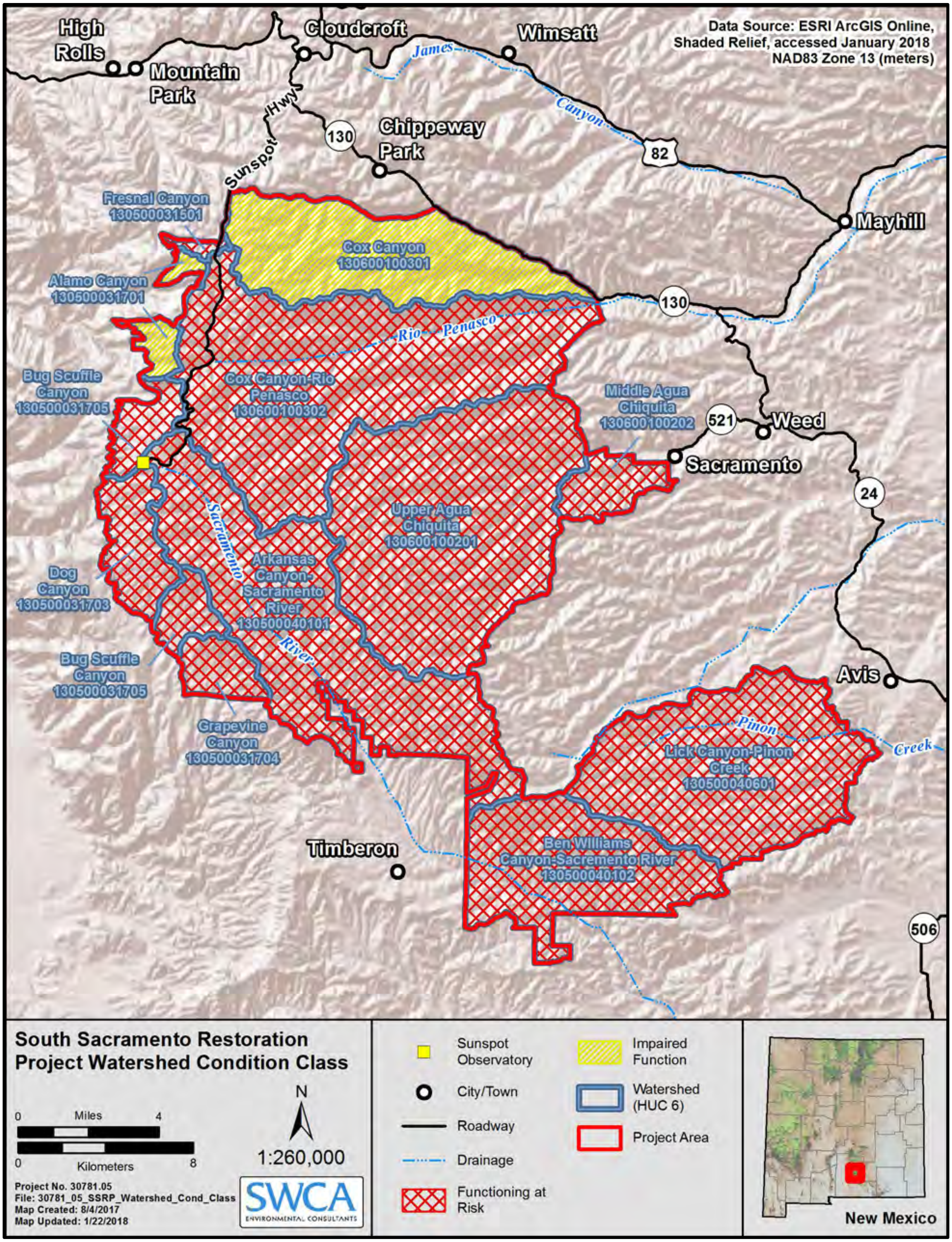

Figure 3-28. Sixth Unit Hydrologic Code Watersheds within the South Sacramento Restoration Project Area and their current functioning condition.

Table 3-20. Current Watershed Condition Class of the Sixth Unit Hydrologic Unit Code Watersheds Found throughout the Project Area

Hydrologic Unit Code 6 Code	Hydrologic Unit Code 6 Name	Acres	Watershed Condition Class	Water Quality Condition	Water Quantity Condition	Soil Conditions	Road and Trail Conditions	Forest Health Condition	Fire Effects/Fire Regime Condition
130500031701	Alamo Canyon	1,700	Impaired function	Good	Poor	Good	Poor	Good	Poor
130500040101	Arkansas Canyon-Sacramento River	23,400	Functioning at risk	Poor	Good	Good	Poor	Good	Poor
130500040102	Ben Williams Canyon-Sacramento River	13,000	Functioning at risk	Good	Good	Good	Poor	Good	Poor
130500031705	Bug Scuffle Canyon	4,100	Functioning at risk	Poor	Good	Good	Poor	Good	Poor
130600100301	Cox Canyon	13,800	Functioning at risk	Poor	Good	Good	Poor	Good	Poor
130600100302	Cox Canyon-Rio Peñasco	30,400	Functioning at risk	Poor	Good	Fair	Poor	Good	Poor
130500031703	Dog Canyon	4,100	Functioning at risk	Poor	Good	Good	Poor	Good	Poor
130500031501	Fresnal Canyon	400	Functioning at risk	Poor	Good	Good	Poor	Good	Poor
130500031704	Grapevine Canyon	2,300	Functioning at risk	Good	Good	Good	Poor	Good	Poor
130500040601	Lick Canyon-Pinon Creek	19,700	Functioning at risk	Good	Good	Good	Poor	Good	Poor
130600100202	Middle Agua Chiquita	2,600	Functioning at risk	Poor	Fair	Good	Poor	Good	Poor
130600100201	Upper Agua Chiquita	27,300	Functioning at risk	Fair	Good	Fair	Poor	Fair	Poor

Water Quantity/Stream Courses

Within the project area, 78 named stream courses covering 242 linear miles were identified using the Lincoln National Forest geospatial database (Figure 3-29). Of the 78 stream courses, nine have stretches that are classified as perennial and represent 38 linear miles. The remaining 204 miles of stream course are classified as either ephemeral or intermittent. A majority of the watersheds have the stream course in good condition; however, the other half, as seen in Table 3-20 above, are rated as being in poor condition. Some of the issues resulting in a rating of poor condition include channel down-cutting, headcut formation, lack of adequate streamside vegetation cover, and a disconnection from the surrounding floodplain habitat. All these conditions have the potential to result in decreased water yield coming from these watersheds and limit downstream users' availability of water. Another possible reason for reduced water yield can be attributed to forest density as the amount of moisture reaching the surface can be limited. The current densities are displayed below in Table 3-21 as the current number of trees per acre and as basal area for the forested ecological response units within the project area. These data were derived from plots measured through the forest inventory and analysis program.

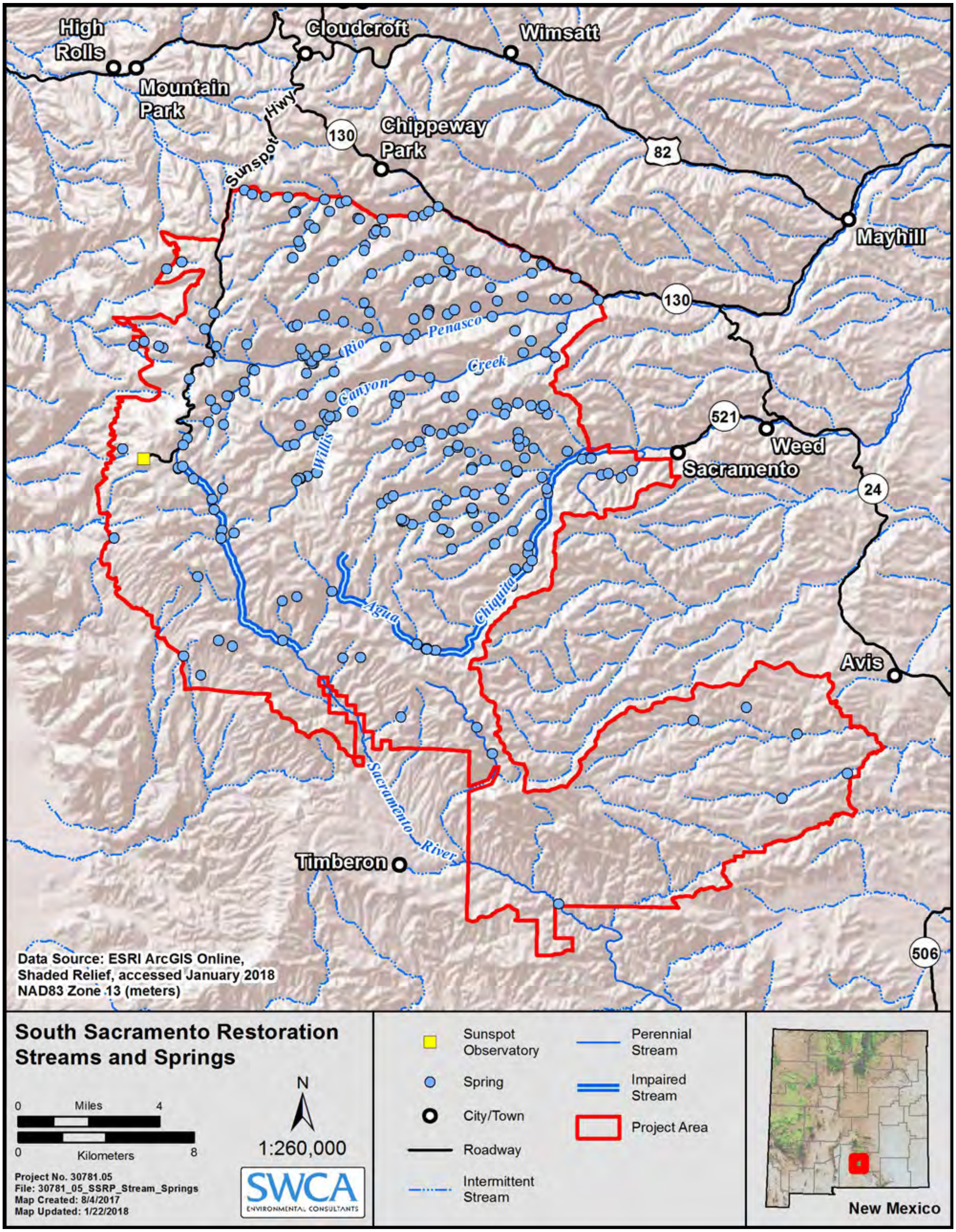

Figure 3-29. Stream courses, springs, seeps, and impaired streams within the South Sacramento Restoration Project Area.

Table 3-21. Current Basal Area and Trees per Acre by Ecological Response Unit within the Project Area

Ecological Response Unit	Portion in Project Area (acres)	Trees per Acre	Basal Area per Acre (square feet)
Mixed Conifer with Aspen Forest	27,613	403	140
Montane/Subalpine Grassland	4,705	Not applicable	Not applicable
Mixed Conifer-Frequent Fire Forest	63,978	460	150
Ponderosa Pine Forest	17,450	463	136
Pinyon-Juniper Woodland	18,998	303	212
Gambel Oak Shrubland	1,117	Not applicable	Not applicable
Pinyon-Juniper Grassland	222	Not applicable	Not applicable
Mountain Mahogany Mixed Shrubland	6,088	Not applicable	Not applicable

Water Quality

The New Mexico Environment Department issues a biannual report on the status of surface water quality on all New Mexico surface waters, including waters on national forest lands. A review of the *2014 - 2016 State of New Mexico Clean Water Act Section 303(d)/Section 305(b) Integrated Report* indicates that the project area contains two streams (30.17 miles) listed for the water quality impairments (State of New Mexico Water Quality Control Commission 2016). The Sacramento River from Scott Abel Canyon to the headwaters, which is a length of 7.30 miles, is impaired due to sedimentation/siltation. The Agua Chiquita perennial portions from McEwan Canyon to the headwaters, a total distance of 22.87 miles, is impaired due to turbidity (see Figure 3-29). Both of these listings can be attributed to the poor condition of roads and trails in this area, which is highlighted in the watershed condition framework table above (see Table 3-20). Roads and trails in poor condition result in increased erosion and subsequent sedimentation leading to a decrease in water quality and overall watershed functioning. Other potential sources of impairment for these streams include channelization, lack of vegetation on banks, drought impacts, and silviculture activates (Harden 2017).

Due to the current impairments the water quality is not meeting the desired conditions to restore the functionality of intermittent and ephemeral streams by promoting vegetative growth of woody and herbaceous native species, reducing tree encroachment into meadow areas and along stream channels, reducing noxious weeds, and increasing resiliency to potential future disturbances. It is expected that restored streams would be able to convey water during high-precipitation events without accelerated channel deepening, headcut formation, or excess erosion.

Riparian Areas, Wetlands, and Springs

No surveys were conducted for riparian areas, wetlands, and springs, so the current information was taken from online databases. The data presented may not represent the current on-the-ground conditions but are the best available data.

Within the project area, there are 246 classified springs throughout the project area (see Figure 3-29). The current condition and functioning of these areas is typically good according to the watershed condition framework. However, since no surveys have been conducted on the verification of these springs the current functioning condition of a majority of these springs is unknown. These areas provided habitat, forage, and water for both native wildlife and domestic livestock. Most of these water resources are at severe risk to damage from catastrophic fire if no treatments are completed.

Soil Resource Condition

Currently, soil hydrologic condition is good, however, it is not currently meeting the desired conditions to protect long-term soil productivity due to the closed forest stand structure and the large accumulation of surface fuels. Due to the closed stand structure, large departure from a natural fire regime, and heavy fuel loading, most soils and associated ecological response units are at risk for severe damage from a high-severity crown fire.

Currently soil stability within the project area is in good condition, which can largely be attributed to the high levels of coarse woody debris and litter and duff. However, due to the closed forest stand structure, with high canopy covers and densities throughout the project area, these areas are at a high risk for the occurrence of crown fire.

Soil nutrient cycling within the project area is currently in good condition, however the current closed stand structure and the large accumulation of surface fuels have put these areas at risk. These factors have also resulted in reduced understory forage productivity. Although there is generally sufficient vegetative ground cover to reduce accelerated erosion, there is not enough herbaceous material to sustain the nutrient cycling which can largely be attributed to the thick fuel layer. Due to these factors the desired conditions to protect long-term soil productivity are currently not being met or sustained.

Incomplete and Unavailable Information

Soils data were addressed at the watershed-level scale due to the lack of data associated with the individual soil units across the project area. There are not enough field data associated with the inventory surveys in order to proceed with confidence using the soil data at the soil unit level.

The functionality and current health of the springs and seeps on the Lincoln National Forest are unknown. However, the data presented in this report are the best currently available data. These data will be used to get an idea of the water resources present on the landscape within the project area.

For water quantity measures, there are no historical flow data available and no flow data will be gathered to document the current condition of water yield from the project area. For water quality measures, no physical stream measurements will be taken to determine current water quality. A narrative description will describe the effects on water quality by alternative, identifying the most current water quality status of perennial waters including streams as identified by the New Mexico Environment Department Surface Water Quality Bureau.

No fieldwork was completed as part of this analysis.

3.4.2 Methodology and Assumptions Used for Analysis

The spatial boundary for analyzing the direct and indirect effects on soils and watershed resources is the South Sacramento Restoration Project boundary because impacts related to soil and watershed resources are not expected to be impacted outside of this area.

For the purposes of the analysis of direct/indirect and cumulative effects, short-term effects are those lasting 2 years or less, whereas those effects lasting longer than this are considered to be long-term effects. The proposed project is expected to last approximately 20 years.

Resource Indicators and Measures

This section describes the methodology and analysis processes used to determine the environmental consequences on the soil and water resources resulting from implementing the proposed action. Table 3-22 describes the resource indicators and the measures used to assess the effects.

The principal issues of concern to soils and water resources from the action alternative is the increase in erosion and consequent impacts to water quality that may occur from implementation of the proposed treatments. Other things being equal (i.e., soil texture, climate, and slope), rates of erosion are closely correlated with vegetative cover, and it is the disturbance of this vegetative cover that is most likely to cause post-treatment accelerated erosion.

Table 3-22. Resource Indicators and Measures for Assessing Effects

Resource Element	Resource Indicator	Measure (quantify if possible)	Used to Address: Purpose and Need, or Key Issue?	Source
Soil condition	Fire Regime Condition Class	Percent area in Class 1, 2, or 3 by Ecological Response Unit	Yes	U.S. Forest Service data
Soil condition	Soil stability	Percentage of ecological response units with severe erosion potential limitations	Yes	Terrestrial Ecosystem Unit Inventory data
Soil condition	Soil nutrient cycling	Dead and downed coarse woody material fuel loading tons/acre and canopy closure (percentage)	Yes	U.S. Forest Service data, Forest Inventory and Analysis data
Watershed condition class	Watershed health	Qualitative measurement of health	Yes	U.S. Forest Service Watershed Condition Framework
Water quantity	Water yield and potential for flooding	Reduction in canopy cover (trees per acre and basal area) qualitative assessment	Yes	U.S. Forest Service data
Water quality	Impaired streams	Qualitative discussion of impacts to impaired streams, seeps, and springs within the project area	Yes	New Mexico Environment Department Surface Water Quality Bureau and U.S. Forest Service data

Analysis of the existing condition of soils and water resources and the potential effects on these resources from the alternatives was accomplished through a review of peer-reviewed literature, reports from regulatory and land management agencies, existing resource inventories, and the professional judgment of the specialist(s). No sampling of soils and water quality was performed as part of this analysis. Information on the existing conditions of soils, springs, riparian areas, and wetlands is presented only for these resources that are found within the project area since proposed actions would likely only affect these resources that are within the project area. Information on the existing conditions of drainage areas and water quality is presented at the sub-watershed scale since proposed actions would potentially affect these resources at this scale.

Soil Resources

The terrestrial ecosystem survey data from the Lincoln National Forest, as well as forest inventory and analysis data, were used to conduct the analysis for soil resources including both soil condition and soil stability (U.S. Forest Service 2018c). This is a system used to classify ecosystem types and map ecological units at different spatial scales. The information assembled about soils in the terrestrial ecosystem survey descriptions and associated data tables are used to predict or estimate the potentials and limitations of soils for many specific uses.

Soil condition is an evaluation of soil quality based on an interpretation of factors that affect vital soil functions. Soil condition is based on the primary soil functions of soil hydrology, soil stability, and nutrient cycling as described by Region 3 Supplement Forest Service Handbook 2509.18. Soil condition was addressed by using fire regime condition class data, soil erosion limitation data, and fuel loading data from the forest inventory and analysis data set. Using these metrics will allow qualitative assessments of soil functioning.

Soil hydrological functioning is assessed using the surrogate Fire Regime Condition Class to assess potential impacts to soil hydrological functioning (U.S. Forest Service 2018c). Since Fire Regime Condition Class is a measure of the degree of departure from reference conditions, it is a good surrogate to soil condition, as the more departed an ecological response unit is from a normal condition the higher the probability of an uncharacteristic wildfire occurring and causing irreversible damages to the soil resources.

Soil stability was analyzed by looking at the percentage of each watershed that has moderate and severe erosion limitation potential. The following soil erosion categories were analyzed: timber harvesting limitation, off-highway vehicle limitations, road limitation, and rill and gulley erosion limitations.

Soil nutrient cycling is assessed by using the current levels of fuel loading as an indices of available material to decompose and be incorporated into the soils and then evaluating how this compares to the acceptable ranges of fuel loading as stated in Forest Service Handbook 2509.18-99-1. Percentage canopy cover change was used as an indices of nutrient cycling, as when more light and water reach the soil surface the more herbaceous and shrub cover recovers and more biomass becomes available for nutrient cycling.

No sampling of soil was performed as part of this analysis.

Watershed Resources

Effects on a watershed resources are assessed qualitatively and quantitatively using the sixth hydrologic unit code watersheds for each alternative by comparing predicted direct, indirect, and cumulative effects by major land-disturbing activities (e.g., forest mechanical treatments, prescribed burning, wildfires, grazing, and past/present/planned anthropogenic actions/structures) within the project area. The Watershed Condition Framework protocol (U.S. Forest Service 2011a, 2011d) was used to classify watershed conditions at the sixth hydrologic unit code level. This framework establishes a reconnaissance-level approach for classifying sub-watershed condition, using a comprehensive set of indicators that are surrogate variables representing the underlying ecological, hydrological, and geomorphic functions and processes that affect watershed condition.

For this analysis, six of the 12 core watershed condition indicators were evaluated for all sixth hydrologic unit codes as described in the soil, hydrology, and watershed report (U.S. Forest Service 2018c). The indicators used included 1) water quality condition, 2) water quantity (flow regime) condition, 3) soil condition, 4) road and trail condition, 5) fire effect and regime condition, and 6) forest health condition.

Water quantity was analyzed by using data available from the U.S. Forest Service. In order to qualitatively asses the impacts to water quantity, reduction in tree overstory (basal area/trees per acre) will serve as the surrogate. In general, reducing forest cover has been found to increase water yield, though stream flow response has also been found to be closely related to climate, particularly the amount and timing of precipitation (Troendle and others 2010).

Water quality will also be addressed in this analysis by using data available from the New Mexico Environment Department, Surface Water Quality Bureau. The general classification used for surface water quality by the New Mexico Environment Department is attaining, attaining some uses, inconclusive/not assessed, not-attaining, and impaired for the identified uses.

Water quality is assessed by comparing existing conditions (Category 1 to 5) with desired conditions that are set by New Mexico under authority of the Clean Water Act (U.S. Forest Service 2018c).

The following information sources were used to develop this report:

- U.S. Forest Service terrestrial ecosystem inventory data (U.S. Forest Service 1986b),
- U.S. Forest Service watershed condition framework (U.S. Forest Service 2011d),
- New Mexico Environment Department surface water quality data (State of New Mexico Water Quality Control Commission 2016),
- peer-reviewed literature.

3.4.3 Environmental Consequences

Alternative 1 – No Action

Under the no action alternative, there would be no vegetation treatments to modify stand structure in order to restore overall forest health, watershed health, and wildlife habitat for each ecological response unit in the project area. Therefore, no ground-disturbance activities from mechanical vegetation treatments would occur. As a result, there would be no risk to soil productivity from disturbance associated with these activities in the short term. However, under this alternative canopy closures would continue to close and tree densities would continue to increase, thus resulting in a long-term decrease in watershed function and resiliency, which poses a serious risk to soils and watershed resources.

Since there would be no vegetation treatments authorized under the no action alternative, forest soils in untreated areas would potentially be vulnerable to the effects of an uncharacteristic stand-replacing wildfire given the departure of existing forest conditions from reference condition, as well as the high levels of fuel loading found within some of the ecological response units. These types of fires can result in large losses of soil nutrients through volatilization, mineralization, and subsequent accelerated erosion (Neary and others 1999). In addition, adverse impacts to soil hydrologic functioning (i.e., reduced infiltration through consumption of soil organic matter, loss of soil structure, and formation of soil hydrophobicity) can occur (Neary and others 2005), which can result in diminished soil condition, watershed health, and water quality.

Fire suppression and historic grazing combined with subsequent favorable weather conditions for conifer recruitment have been identified as causative factors in the high densities of trees in southwestern coniferous forests under post-European settlement conditions (Covington and others 1997). The high canopy cover in these forests has reduced understory shrub and herbaceous species leading, in some cases, to monoculture stands of stunted trees. Under the no action alternative, the current forest structure would remain unaltered. The density of forest overstory cover would remain higher than historic evidence suggests it was and herbaceous and shrub species would continue to be suppressed. The risk of stand-replacing fires would remain elevated.

Implementation of Alternative 1 would not meet the project's purpose and need to improve and protect soil condition, productivity, and watershed function nor move towards the desired condition of having soils in satisfactory condition and soil productivity maintained and watersheds properly functioning (Table 3-23). It would not meet the project's purpose and need nor move towards the desired conditions of a resilient forest by reducing the potential for undesirable fire behavior and its effects and maintaining the mosaic of tree groups and interspaces with frequent, low-severity fire by having a forest structure that does not support widespread crown fire. Implementation of Alternative 1 would not increase forest resiliency to natural disturbances and would not improve or protect soil condition and soil productivity or watershed function, as well as the proposed action. Implementation of Alternative 1 would put soils and watersheds at risk of continued uncharacteristic wildfires that could result in loss of soil productivity and sediment delivery to stream courses within the project area. Implementation of Alternative 1 would not reduce the risks to life, property, soil productivity, and water quality from post-wildfire storm events (flooding and debris flows).

Table 3-23. Resource Indicators and Measures for Alternative 1

Resource Element	Resource Indicator	Measure (quantify if possible)	Alternative 1 Direct/Indirect Effects
Soil condition	Fire Regime Condition Class	Percentage of project area in Class 1, 2, 3	All of ecological response units are within FRCC 2 or 3, which is out of a normal fire regime. Without treatments these areas are susceptible to large uncharacteristic wildfires which would directly impair the soil condition.
Soil condition	Soil stability	Percentage of ecological response units with severe erosion potential limitations	There would be no direct or indirect effects on soil stability if Alternative 1 is selected as no ground-disturbing activities would occur. However, the long-term potential direct impact from wildfire still exists.
Soil condition	Soil nutrient cycling	Fuel loading tons/acre and canopy closure (percentage)	Fuel loading would continue to be at elevated levels thus putting the soil condition at a direct risk if a wildfire were to occur. The current fuel loading data show that some of the ecological response units have areas that are magnitudes higher than the average range of variability. Canopy closures would still exceed acceptable levels to reduce wildfire potential and meet the desired condition of having a resilient forest.
Watershed condition class	Watershed health	Qualitative measurement of health	The current watershed condition class would remained unchanged with the selection of Alternative 1 with no direct impacts. Without treatments the watersheds would remain in their current condition class if not deteriorate further.
Water quantity	Water yield	Reduction in canopy cover (trees per acre and basal area) qualitative assessment	Water yield would not increase and would potentially continue to diminish as the forest density and litter layers continue to increase.
Water quality	Impaired streams	Miles of impaired streams within the project area	30.17 miles of streams that are currently impaired would continue to be impaired or deteriorate further.

Alternative 2 – Proposed Action

Direct and Indirect Effects

Implementing the proposed action would have both negative and positive short-term impacts to both the soils and watershed resources, as well as long-term beneficial impacts to both resources. The direct and indirect effects are discussed below by restoration methods and associated activities that could be implemented and have an impact on soil and watershed resources if Alternative 2 is chosen. The proposed use of herbicide applications, mobile incinerators, water developments, and interpretative sites restoration methods are expected to have a negligible impact to soils and watersheds and are not discussed further.

Direct/indirect effects on soils and watershed resources are analyzed within the proposed project boundary since any impact to these resources by proposed treatments would most likely occur at or in their immediate vicinity. For example, soils are most likely to be impacted by those activities that occur directly on them as opposed to activities that are distant from the soil resource. In the case of water quantity and quality, direct/indirect effects are analyzed at the watershed and stream-course scale.

Vegetative Thinning

It is expected that up to 35 percent of the project area (about 54,000 acres) will be open to conduct mechanized vegetation thinning treatments. Table 2-7 in in Chapter 2 summarizes the various vegetation thinning tools, locations where each tool may be used, and general operating conditions that would be considered when developing site-specific treatment prescriptions. It is expected that vegetation thinning would result in localized ground disturbance, however, it should be noted that not all 54,000 acres will be treated in the same year. Therefore, the short-term impacts to soil resources from the removal of the protective covering should be negligible especially when taking the resource protection measures in Chapter 2 into consideration.

Hand Thinning

It is expected that a minor amount of hand thinning using chainsaws and hand piling of downed material with no yarding of felled timber would be implemented within the project area. Hand thinning would result in minimal impacts to soils and watershed resources since no construction of temporary roads would be needed, and heavy machines would not be used for felling and transporting of harvested timber. Soil disturbance from hand thinning operations is generally considered negligible (Berg and Azuma 2010; Robichaud and others 2005). No long-term loss of soil productivity nor accelerated erosion would be expected to occur from hand thinning and hand piling operations. Watershed condition, water quantity, and water quality would all see positive long-term beneficial impacts due to the reduce density of the forested watersheds.

Ground-based Mechanized Thinning

Mechanized thinning, which can include mechanical whole tree, manual harvesting, cut-to-length skyline yarding, machine piling, and mastication, is expected to occur within roughly 36 percent of the project area across all ecological response units. Ground-based harvesting involves the use of either wheeled or tracked machinery in contact with the ground surface to both cut trees and remove them from the harvest area to landings in a process called “yarding.” Ground-based harvesting systems include whole-tree harvesting systems in which trees are felled and the entire tree is skidded from the harvest area to landings, where the trees are further processed by delimbing and bucking (i.e., cutting the trees to specific lengths) and cut-to-length systems in which trees are felled and processed at the stump with transport of processed logs to landings. In whole-tree harvesting, trees are generally felled and bunched using a tracked or rubber-tired feller-buncher and tree bunches are skidded (i.e., dragged with crowns in contact with the ground) along designated skid trails to landings. Skidding is generally accomplished using tracked or rubber-tired skidders. In cut-to-length systems, trees are generally felled using a harvester equipped with a head that allows both cutting and processing of trees. Logs are then transported to landings using a forwarder that carries the logs fully suspended from the ground in a trailer-type fashion. Occasionally, harvesting and forwarding is accomplished with a single piece of equipment referred to as a “harwarder.” There are various types of harvesters including trackhoes fitted with processing heads as well as multi-wheeled machines that are capable of operating on slopes exceeding 40 percent. Where work is conducted in areas of greater than 40 percent slopes there could be short-term impacts to the soil resources due to exposure, which could result in localized erosion and on the rare occasion transportation of sediment to stream channels. However, these impacts will likely be short term in nature as it is expected that recovery of the vegetation layer would occur during the first growing season and the resource protection measure would be implemented to prevent erosion before the vegetation has had the chance to establish.

Ground-based mechanized thinning has the potential to causes direct impacts to soils including compaction, displacement of surface soil, rutting, and exposure of bare mineral soil. These direct impacts could result in a short-term indirect impacts to watershed resources, particularly water quality, if an increase in erosion and sedimentation is experienced. Soil loss following mechanical treatments can largely be attributed to the network of temporary roads, skid trails, and landings needed to accomplish thinning. These effects have the potential to alter soil productivity, as well as surface runoff and erosion rates, which are normally very low under undisturbed forest conditions (MacDonald and Stednick 2003). In turn, changes in surface runoff and erosion may have an effect on water quality primarily through increased sediment delivery to stream courses, however it is expected that adjacent untreated areas would serve as buffers that would help mitigate the potential for sediment to move into a stream course. Research from the Sacramento Mountains, however, has shown that low to moderate soil disturbance by mechanical operations did not result in increased runoff or sedimentation compared to nondisturbed sites, even on steep slopes (Cram and others 2007). The proposed action is not expected to have long-term negative impacts to the soil and watershed resources because the developed resource protection measures designed for this project would be followed (see Chapter 2, Section 2.2.5).

Skyline Yarding

Skyline yarding is another form of mechanical treatment which uses a system of cables to drag one end of logs or whole trees from the cutting unit to a roadside landing. In this way, logs or whole trees are partially suspended, which decreases the amount of disturbance that might otherwise occur if both ends of the log or whole tree remained on the ground. It is used on sites that are too steep for ground-based operations. A skyline yarder remains stationary on a road and supplies the power to operate the cables that pull in the harvested stems. A skyline is strung from the yarder and anchored to a tailhold at the bottom of the cutting unit. Roughly parallel “corridors” for the skyline would need to be placed every 100 to 140 feet. These corridors would be approximately 12 feet wide. Logs would be laterally yarded to this corridor and then hauled up the skyline to the landing. Skyline yarding is not limited by slope. If whole trees are yarded to the landing, a processor can manufacture the stem into logs just as in conventional ground-based operations.

The types of disturbance to soils from skyline yarding are the same as those for ground-based mechanized harvesting but the magnitude of disturbance in terms of the area with visible soil disturbance, such as exposed soil and rutting, would be less than ground-based harvesting/yarding (Reeves and others 2011). In a study comparing the extent of soil disturbance associated with ground-based yarding, cable yarding, and helicopter yarding, Reeves and others (2011) found that ground-based yarding produced the most soil disturbance (roughly 8.2 percent of harvested area excluding roads) with cable yarding next (roughly 3.8 percent of harvested area excluding roads).

Mastication

Mastication treatments often use tracked machines with an attached vertical or horizontal shaft head mounted on an excavator boom or directly on the front of the vehicle (Harrod and others 2009; Rummer 2010). The masticator heads shred or grind the woody material into coarse, irregular pieces and the material can be hurled up to 100 feet or more. Mastication machines are commonly used in the local area and can operate on slopes up to a maximum of about 30 percent. This method avoids the need for skid trails, landings, or log haul traffic. Mastication has been found to cause fewer disturbances to soil stability than alternative methods of woody debris disposal following tree thinning treatments (Owen and others 2009). Masticators shred the entire tree, scattering the shredded wood pieces across the forest floor for later broadcast burning or natural decomposition. They turn woody material into light mulch that remains on the ground, retaining soil moisture, reducing soil erosion, and adding nutrients.

Through these treatments active crown fire risk will likely be reduced in each of the forested ecological response units, however, there is potential for short-term direct impacts as the substantial increase in surface woody fuel loadings and increased continuity of woody fuel cover may lead to high-intensity surface fires that are difficult to control. However, it is expected that the resource protection measure (Veg-5) would limit the amount of fuel that is masticated. Therefore, it is not expected that mastication would result in any negative long-term direct or indirect impacts to the soils and watershed resources. Mastication does have the potential to cause long-term beneficial impacts to both the soil and watershed resources through the reduction of potential for a high-severity wildfire to occur.
The masticated material would also provide ground cover and aids in the long-term health of the soil productivity through the increased nutrients available to be cycled into the soils.

Whereas the direct and indirect effects of this alternative on soil resources is largely concerned with on-site impacts to soils that reduce productivity, the direct and indirect effects on water quality are largely concerned with the movement of sediment from hillslopes to stream courses. The potential effects of the various action alternatives on water quality are related to the extent to which disturbance from the various treatment methods affect hillslope erosion and whether mobilized sediment would reach stream courses. Hillslope erosion depends on such factors as amount of soil exposed, changes to infiltration rates, slope steepness, type and depth of soil, and the nature of precipitation (i.e., type and intensity) (MacDonald and Stednick 2003). The movement of sediment from actively eroding hillslope areas to stream courses is dependent on these same factors plus the spatial aspects of disturbance (i.e., whether disturbed areas are surrounded by relatively undisturbed areas, and the proximity of disturbance to stream courses), and the types of post-treatment mitigation methods or resource protection measures that are applied. Identified and implemented resource protection measures (see Chapter 2, Section 2.2.5) would reduce the risk of accelerated erosion, sediment delivery to connected stream courses, and maintain water quality in all watersheds.

Use of Wildland Fire

The use of wildland fire is another restoration method that will be used on approximately 73 percent (101,600 acres) of the project area. Wildland fire is a general term describing any non-structure fire that occurs in vegetation and/or natural fuels. There are two classes of wildland fire: planned (i.e., prescribed fire) and unplanned (wildfire). Prescribed fire (also called controlled burning) refers to any kind of fire that is planned in advance and applied under preselected conditions that are favorable to meet project objectives. Under certain conditions, wildfires may be allowed to burn to meet identified management objectives. This policy has been referred to as “fire use,” “fire managed for resource benefit,” “wildfire for multiple objectives,” and other terms. Both wildfire for multiple objectives and prescribed fire would be allowed to occur within the project area under the proposed action. The use of wildland fire can have short-term direct and indirect impacts to the soil and watershed resources through the removal of the soil protective cover which can result in increased erosion rates and potential for sediment to get into waterways. The use of wildland fire is not expected to have any long-term negative impacts as vegetation usually recovers 1 year following fire. However, long-term effects may occur if fire intensity is too high and soils become sterilized. This is not likely to occur if the resource protection measures develop for the project are implemented.

Broadcast Burning/Jackpot Burning

Fuel treatments using prescribed fire are proposed under this alternative either as “burn only” treatments (i.e., no other method of treatment) or following treatment in areas where it is necessary to reduce the fuel load through either hand or mechanical thinning prior to the introduction of fire. Both broadcast and jackpot burning would be used. Broadcast burning is the burning of scattered slash over a wide area while jackpot burning is a modified form of broadcast burning where the target fuels to be ignited are the concentrations (or jackpots) of vegetative fuel. In both cases, the effects are anticipated to be similar since prescribed fire would not likely be introduced for several years following mechanical treatment, when enough fine fuel has accumulated to carry a fire.

The conditions under which prescribed burning would be conducted are generally characterized by high relative humidity, low air temperatures, low fuel loadings, and high fuel moisture. These conditions typically produce low burn severity in which surface litter is only partially consumed. In addition, the timing of controlled burns is such that burns are conducted during fall or spring, when lower ambient temperatures minimize surface litter consumption. Prescribed fires, however, do produce spatial variations in burn severity ranging from high to unburned depending on surface fuel loads. This spatial variability leads to varying runoff and erosion rates (Robichaud and others 2010).

In areas of low to moderate soil burn severity, only a portion of the surface organic matter is consumed leaving adequate soil cover over much of the burned area. In general, prescribed fire does not cause excessive erosion or sediment transport since soil cover is retained in a discontinuous pattern across the landscape. Because of this, long-term adverse direct impact to soils and watersheds resources are not expected from prescribed fire activities. This conclusion is supported by controlled burning experiments conducted on the Fort Apache Reservation located in the White Mountains of northeastern Arizona, which indicated minimal soil erosion following controlled burning (Cooper 1961; Weaver 1952). Cooper (1961) evaluated post-burn erosion on a 35 percent hillslope in the White Mountains and concluded that accelerated erosion attributable to controlled burning could not be considered severe and that the soil appeared to be stabilized within 1 year of treatment. It was also noted that eroded material was only moved a short distance downslope. Conversely, prescribed burning would be expected to have a long-term benefit to soil and watershed resources by reducing the build-up of fuels and restoring soil nutrient cycling through reduction of overstory and encouragement of herbaceous cover. These results would also result in a beneficial long-term improvement of the watershed condition class, water quantity, and water quality throughout the project area and surrounding landscape.

Pile Burning

Another proposed method is the machine pilling of slash generated from restoration in order to burn. Pile burning would be used following hand or mechanical treatments to remove activity slash created during thinning activities. Bulldozers or similar heavy equipment are most commonly used to pile slash. Slash may be hand piled in areas with limited amounts of downed woody debris, where highly erodible soils occur, or on steep slopes and other areas that are not accessible to heavy equipment. Pile burning allows time for the vegetative material to dry out and would produce less overall smoke by burning hot and clean. The first entry with prescribed fire may be in the form of pile burning to initially reduce the amount of thinned vegetation on the ground. Pile burning may also be used where broadcast or jackpot burning are not an option.

Burning of slash piles has been shown to negatively affect soil biotic and chemical properties due to intense soil heating (Korb and others 2004; Seymour and Tecle 2005). Burning can result in soil sterilization, increased erosion risk, and an increased risk of invasive and noxious weeds that displace native vegetation. Pile burning sites would constitute a small portion of the project area; therefore, the impacts to the soil resources are unlikely to result in long-term impacts to the water quality due to sediment increases. Monitoring of these sites for the presence of invasive or noxious weeds following pile burning, and treatment of any infestations found would mitigate most adverse effects on soils and watershed resources caused by pile burning of slash.

Other Restoration Methods

Other restoration methods that may be implemented under this alternative could include site rehabilitation and planting, watershed improvement and erosion control, water developments, recreation sites improvement, and the development of interpretive sites. These methods are described below, as well as the direct and indirect impacts that may occur to soils and watershed resources.

Site Rehabilitation and Planting

Site rehabilitation may be required to mitigate effects caused by the project activities described above, including but not limited to the rehabilitation of skid trails and temporary roads constructed for treatment activities. Long-term site rehabilitation may also be required following any wildfires that may occur within the project area. Rehabilitation may include reseeding using native grasses and forbs or replanting native woody species. Site rehabilitation and planting activities could occur anywhere within the 140,000-acre project area, depending on need. It is most likely that tree planting would occur in mixed conifer or ponderosa pine forests. Site rehabilitation and planting would provide both short- and long-term beneficial impacts to the soil and watershed resources through protection of the bare mineral soil and reduce the paths that could carry concentrated flows laden with sediment to stream channels. Overall these methods would help the project area trend towards the desired conditions of maintaining and improving watershed functioning condition and would not result in any short- or long-term negative impacts.

Watershed Improvement and Erosion Control

Watershed improvement treatments would be designed to help the watersheds trend towards the desired conditions of maintaining and improving watershed functioning condition. Watersheds that are properly functioning have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients within the range of the natural variability for these processes (U.S. Forest Service 2011d). Restoration techniques would be designed to stabilize headcuts and other erosion issues in upland areas and along roadsides or similar areas: aeration of select meadows for plantings to increase diversity of forb and grass species and stabilization of ephemeral and intermittent channels to aid wildlife and livestock distribution, repair damage associated with dispersed and informal recreation, and improve road and trail conditions. These actions are expected to have both short- and long-term beneficial impacts to both the soil and watershed resources, including increased protection from sedimentation to downstream water users. Increased sediment loads have the potential to reduce the water quantity and quality and therefore the ability of downstream users to use the water resources. However no negative effects are expected to occur as a result of the activities due to the resource protection measures described in Chapter 2. It is expected that there will be beneficial impacts due to the reduced soil erosion, which will likely result in an increase in the vegetative cover.

Special Use Authorizations

During public scoping and meeting with project stakeholders, the U.S. Forest Service was asked to identify areas within the project area that could be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerator sites, etc. Tasks carried out at processing sites include drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, scaling and weighing logs, and creating poles from suitably sized logs. Equipment types commonly used at processing sites include circular or band saws, various sizes and types of front-end loaders, log loaders, and chippers of several types, and may include timber processors, planers, associated conveyers, and log sorting bunks for accumulation and storage of logs. Electric motors and gas or diesel generators are also used to provide power. Mobile incinerators may also be used at these sites.

Large processing sites are typically greater than 10 acres in size. Large sites allow for more flexibility in their design and allow for more areas to process, grade, scale and sort logs, manufacture materials, and chip and haul products. Medium-sized processing sites are 5 to 10 acres in size and log processing, equipment use, and storage are more limited. Landings at a timber sale area are considerably smaller than log sort yards and typically are about 0.33 acre.

It is expected there would be short-term effects resulting from the activities within these areas that increase soil exposure and potential erosion. However, these impacts are not expected to occur long term as sites would be restored following implementation activities, and all necessary resource protection measures to limit damages to the soil and watershed resource during implementation would be followed (see Chapter 2, Section 2.2.5).

Road Management

Road management is an important aspect of the proposed action as the current road conditions within the project area are considered in poor condition according to the watershed condition framework (U.S. Forest Service 2011d). Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 125 miles of existing and new National Forest System roads would be used to complete the proposed activities and could include temporary road creation, rehabilitation of unauthorized routes, and road maintenance activities including constructing and/or improving drainage features. Temporary roads would be obliterated and rehabilitated after vegetation thinning, prescribed fire, and watershed restoration and site rehabilitation treatments are completed.

Road management activities will have negative long-term impacts to the soil resources through the compaction and removal of the soil function where permanent roads are constructed. Short-term impacts are expected where access roads are constructed, but these impacts are not expected to persist once rehabilitated. However, the short- and long-term impacts to watershed resources due to the increased erosion and subsequent sedimentation of streams can be mitigated through proper design and maintenance, and the application of the designed resource protection measures (see Chapter 2, Section 2.2.5). Due to these methods the amount of mobilized sediment reaching stream courses would be minimized but not necessarily eliminated because of the nature of precipitation events in the Sacramento Mountains. In particular, the convective storms that occur during the summer months may produce locally intense rainfall that drastically increases erosion in the absence of disturbance. Though rates of erosion in undisturbed forested areas of the western interior of North America are typically low, erosion rates may increase by several orders of magnitude as a function of the nature of heavy precipitation (MacDonald and Stednick 2003).

Soil Condition

Soil condition under this alternative will be improved due to the combination of mechanical treatments, prescribed fire, and other restoration measures. The effects of implementing the proposed action are expected to have positive long-term impacts to the Fire Regime Condition Class of the ecological response units. The short-term negative impacts resulting from the implementation of the proposed action would be the limited removal of the vegetation layer from mechanical treatments, prescribed fire, and managed natural ignitions, which may result in minor localized erosion. However, no long-term negative impacts are expected to be associated with implementing the proposed action especially considering the extensive resource protection measures developed to mitigate impacts. The long-term beneficial impacts of this project would be the restoration of a normal fire return interval thus shifting the Fire Regime Condition Class to a more sustainable state and helping the project trend towards the desired condition.

Soil Stability

The proposed action treatments will also protect the soil stability throughout the project area through the reduction of wildfire potential include in areas where slopes exceed 40 percent. The thinning treatments followed by the use of fire would limit the potential for a catastrophic wildfire. The reduction of tree density coupled with the treatments should result in an increased herbaceous layer which will aid in further stabilizing the soils within the project area. The mitigation measure aimed at road improvements and the stabilization of erosion features will also increase the resiliency of the soil resources to erosive forces. This implementation of the proposed action will result in long-term beneficial impacts to the soil condition and help the area trend towards meeting the desired conditions of protecting long-term soil productivity by maintaining satisfactory soil conditions where it is presently in good condition and improving soil condition and function where soils are currently impaired.

Soil Nutrient Cycling

The implementation of the proposed action would also benefit the soil nutrient cycling as the potential for uncharacteristic wildfire within the project area would be reduced. Nutrient cycling would be positively impacted though the opening up of the forest canopy, which provides more light and water to the soil surface and allows for an herbaceous understory to reestablish (see Table 3-24) in the soils, hydrology, and watershed report, U.S. Forest Service 2018c). This herbaceous cover in turn helps stabilize soils and increase soil organic matter that will benefit the long-term productivity of the soils and improve soil condition. More moisture and light will also allow for a more rapid decomposition of the fine and coarse woody material. Dead and downed woody material is only expected to increase in the wet mixed-conifer ecological response units while decreasing in the rest. This alternative meets the purpose and need and helps address some of the issues of concern highlighted in Chapter 1.

Watershed Condition

Through the implementation of the proposed action there would be long-term beneficial impacts to the watershed condition classes. The combination of mechanical treatments, prescribed fire, and other restoration measures, which may include road and trail maintenance, upland erosion mitigation, and replanting of disturbed areas would help shift these areas from functioning impaired and at risk to a proper functioning condition, which is a desired condition of the project. No short- or long-term adverse impacts are expected as the proposed action is implemented and the resource protection measures are followed. Implementation of the proposed action would help with the issues highlighted in the purpose and need of the project that look to reduce high-severity fire risks and post-fire flooding potential to protect life, property, and natural resources, as well as improve watershed function where impaired. The proposed action will also help improve hydrologic function of springs and seeps, and the quality of perennial and intermittent waters and riparian areas over the long term through increasing the resiliency of the forest to wildfire and insect and disease outbreaks. The treatments will also reduce the forest density and allow for more precipitation to reach the surface which may increase recharge to springs and seeps.

Water Quantity

Water quantity under the proposed action would be maintained and improved through the reduction of tree density on the watersheds as described in the soils, hydrology, and watershed report (U.S. Forest Service 2018c). It is expected that the proposed action would result in a 10 to 30 percent reduction in the forest density across the ecological response units. This reduction not only lowers the potential for uncharacteristic wildfire, but also increase the potential water yield for up to 5 years following project implementation (Baker 2003) after which water yields start to return to pre-treatment conditions. Water yield is not expected to be adversely impacted by the proposed action, in fact it will improve as more areas are treated. Through the proposed action the amount of water that may increase after restoration would result in improvements to downstream water users, as well as the functioning of springs, seeps, and riparian areas as well as meadows that are located in proximity to drainage features.

Water Quality

Water quality under the proposed action would see beneficial short- and long-term impacts as a result in the reduction of the forest overstory and current fuel load condition that are currently putting the project area at risk for an uncharacteristic stand-replacing wildfire. Mechanized restoration treatments may locally alter surface cover and soil infiltration rates but these areas of disturbance are likely to only persist for a short time and will be surrounded by undisturbed areas that act as buffers for absorbing runoff and reducing the possibility of sediment entering stream channels. Combined with the resource protection measure it is expected that no negative impacts would result to water quality from implementation of the project. Overall, this action would result in improvements to water quality due to the restoration proposed on the road and trail system, which is a sizable producer of sediment in the project area as well as adhering to the resource protection measures. The proposed action may also result in the significant improvements that could result in the 30.17 miles of impaired streams within the project area no longer being impaired.

Overall, long-term soil productivity and watershed function for the proposed action are expected to be protected, maintained, or improved across the project area. Implementation of this alternative would reduce the risks to life, property, soil productivity, and water quality from post-wildfire storm events (flooding and debris flows). Implementation of Alternative 2 would meet the project's purpose and need, as well as meet Lincoln National Forest standards and guidelines (Table 3-24).

Table 3-24. Resource Indicators and Measures for Alternative 2 Direct/Indirect Effects

Resource Element	Resource Indicator (quantify if possible)	Measure (quantify if possible)	Alternative 2 Direct/Indirect Effects
Soil condition	Fire Regime Condition Class	Class 1 through 3	The proposed action is not expected to have any negative direct or indirect impacts to the Fire Regime Condition Class. However, the implementation of the proposed action would result in long-term beneficial direct and indirect impacts to soil condition as these areas will be moving towards a more natural fire return interval that will limit the potential of a high-severity wildfire.
Soil condition	Soil stability	Percentage of ecological response units with severe erosion potential limitations	The percentage of the area where moderate to severe erosion potential limitations would not change as a result of the proposed action. However, the proposed action would result in these areas being more resilient to disturbance, such as fire, that would protect these soils from potential erosion issues. Conversely, the resource protection measures that are in place would limit the amount of soil exposed and available to be transported as sediment to waterways. Overall, the proposed action is expected to provide long-term direct benefits to the soil resources through the protection and maintenance of the soil surface cover.
Soil condition	Soil nutrient cycling	Fuel loading tons/acre	The proposed action would result in long-term direct impacts to the soil nutrient cycle. The proposed action would move the watersheds to a more natural fire return interval, thus protecting the

Resource Element	Resource Indicator (quantify if possible)	Measure (quantify if possible)	Alternative 2 Direct/Indirect Effects
			nutrient availability. It is expected that through the implementation that the long-term nutrient cycling would be improved due to the reduction in wildfire potential and the increase in canopy openings that increase light and water to the soil surface resulting in more herbaceous ground cover. No adverse impacts are expected to occur from implementation of the proposed action.
Watershed condition class	Watershed health	Qualitative measurement of health	The proposed action is expected to help the watersheds currently functioning at risk and impaired transition into a proper functioning condition. The proposed action is not expected to cause any negative impacts. The current state of the trails and the roads within the watersheds are largely attributed to the decline in health. However, the proposed action is designed to mitigate this issue through the application of restoration techniques that include headcut stabilization, tree replanting, road maintenance, and trail improvements. It is expected that over the long-term life of the project (20 years) that there would be positive long-term impacts that would help the watershed transition to a proper functioning condition.
Water quantity	Water yield	Reduction in canopy cover qualitative assessment	No negative short- or long-term impacts to water yield are expected as a result of the proposed action. Water yields are expected to increase for up to 5 years following treatments that reduce the overstory canopy.
Water quality	Impaired streams	Miles of impaired streams within the project area	It is expected that the current reaches of streams that are impaired would be rehabilitated during the project life. The reasons for impairments are sediment and turbidity, which are directly related to the poor road and trail conditions within the project area that are expected to be improved.

Cumulative Effects

The spatial boundary for analyzing the cumulative effects on soils and watershed resources is the Sacramento Ranger District, as it represents a reasonable region in which soils and watershed resources, when assessed in combination with other cumulative actions, would be impacted if the proposed project were implemented. The temporal boundary for analyzing the cumulative effects is 30 years, because restoration methods are anticipated to have taken effect in that time period.

See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on soil and watershed resources.

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 cumulative short-term adverse and long-term beneficial impacts on soil and watershed resources. Short-term impacts could include removal of soil function from the creation of temporary roads, which could result in an increase in localized soil erosion. Short-term increases in soil erosion could also impact water quality depending on the proximity of the project to stream courses. These impacts are expected to be mitigated on a project-by-project basis through the application of resource protection measures so it is not anticipated that cumulative negative impacts would result from the implementation of the proposed action coupled with other restoration activities

Other restoration activities would occur on adjacent public lands, including the Rio Peñasco Two Project, Jim Lewis Fuel Reduction Project, Two Goats Restoration Project, and Westside Watershed Restoration Project restoration treatments, would also increase ecosystem resilience in the Sacramento Mountains. Combined, these projects would treat up to approximately 94,000 acres over the next decade. Mechanical treatments and other restoration activities on the adjacent state lands and tribal lands would further increase long-term forest health and as a result of reduced risk of wildfire, which could improve the forest's resiliency in a changing climate and decrease the potential for soils to erode and create sediment problems within the water course. However, it is expected that all projects will complement each other to create beneficial cumulative effects (Table 3-25).

Table 3-25. Resource Indicators and Measures for Alternative 2 Cumulative Effects

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternative 2 Cumulative Effects
Soil condition	Fire Regime Condition Class	Class 1 through 3	Reduction of fuels on the adjacent landscape from other projects combined with this project would help in moving the current condition classes to a more natural fire regime that is within the natural variability of the system. This would have long-term beneficial impacts to the soil condition as the potential for an uncharacteristic wildfire decreases considerably and the forest increases resiliency to insect and disease outbreaks.
Soil condition	Soil stability (erosion potential)	Percentage of ecological response units with severe erosion potential limitations	The reduction of wildfire potential across the landscape helps also lower the erosion potential as the ground and canopy covers are not completely consumed or removed. Therefore, it can be expected that the cumulative impacts from the adjacent projects will be long term and positive with regards to soil stability.
Soil condition	Soil nutrient cycling	Dead and downed coarse woody material fuel loading tons/acre and canopy closure (percentage)	Reduction of canopy cover as well as fuels on the adjacent landscape from other projects combined with this project will help in reducing the current fuel loads through both mechanical and fire treatments. Reducing the canopy cover and fuel loads across the landscape would provide beneficial impacts to the soils and watershed resources by removing fuels that if left unattended could result in long-term impacts to soil condition through extreme soil heating and a loss of an organic cover. It would also allow for more water and light to reach the surface resulting in an increase in herbaceous and shrub cover. Increasing these layers would have long-term direct impacts to soil nutrient cycling that would provide positive benefits to the sources.
Watershed condition class	Watershed health	Qualitative measurement of health	The combination of all the surrounding projects in the landscape is expected to help improve the sixth code hydrologic unit watersheds within the project area as a result of the reduction of fire risk as well as increased forest resiliency to insect and disease outbreaks. This will provide a long-term positive impact to all of the watersheds in the cumulative impact area. Adverse impacts to watersheds are not expected as a result of the implementation of these projects.
Water quantity	Water yield and potential for flooding	Reduction in canopy cover (trees per acre and basal area) qualitative assessment	Projects outside of the project area are not expected to have a direct impact on water quantity, except for those streams that are formed outside of the project area. The reduction of wildfire potential in the surrounding landscape lowers the potential in the project area which helps protect streamflow quantity.

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternative 2 Cumulative Effects
Water quality	Impaired stream	Qualitative discussion of impacts to impaired streams, seeps, and springs within the project area	Projects that occur outside of this project area are expected to have long-term positive impacts on water quality due to the reduction in risk of wildfire and increased forest resiliency to insect and disease outbreaks. Projects that are implemented outside of this project area could cause short-term indirect impacts to water quality on streams flowing into the project area if ground-disturbing activities over large areas remove the protective soil cover. Impacts may include short-term increased sediment production and reduced water quality.

3.4.4 Forest Plan Amendments

The Lincoln National Forest Land and Resource Management Plan (Forest Plan) amendment that would allow mechanized equipment to be used on slopes greater than 40 percent in the project area to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives would result in beneficial impacts to the soil and watershed resources in the project area. Allowing treatment to occur on steeper slopes would provide access to timber that otherwise would not be removed from National Forest System lands. By expanding the areas in which forest restoration would occur in the project area, wildfire risk would be reduced, and long-term beneficial impacts to soil and watershed resources would result because high-severity wildfires that produce large amounts of post-fire soil erosion and subsequent sedimentation would be less likely to occur. Furthermore, forest restoration activities on steep slopes would improve forest health and resilience in a larger portion of the project area, thereby resulting in increased watershed functioning.

Similarly, the proposed amendments allowing forest restoration treatments to occur in Mexican spotted owl protected activity centers would result in beneficial impacts to soil and watershed resources because fuels in these areas would not be removed without the amendment. A long-term reduction in wildfire risk and beneficial impacts to soil and watershed resources would result from the proposed amendment. Forest restoration activities within protected activity centers would improve forest health and resilience in a larger portion of the project area, thereby resulting in decrease in wildfire potential.

The Forest Plan amendment to authorize the management of unplanned wildfires for multiple resource objectives across portions of the project area where this management is not currently authorized would also result in long-term reduction in wildfire risk and subsequent beneficial impacts to soil and watershed resources.

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to soils, hydrology, and watersheds from the no action alternative and proposed action. The proposed action would have the greatest impact to soil and watershed resources within the project area. The proposed action would result in long-term beneficial impacts to soil and watershed resources by reducing the risk of uncharacteristic, high-severity wildfires, as well as increasing the resiliency of the forest to handle disease and insect outbreaks. Short-term adverse impacts to soil and watershed resources under the action alternative would be limited due to the resource protection measures. It is not expected that the proposed action would result in any long-term adverse impacts to soil and watershed resources.

3.5 Threatened and Endangered Fauna Species

3.5.1 Affected Environment

The U.S. Fish and Wildlife Service lists six federally threatened, endangered, candidate, other sensitive fauna species with the potential to occur in the project area (Table 3-26). This includes one experimental, non-essential population (Northern aplomado falcon, *Falco femoralis septentrionalis*) and one candidate (Peñasco least chipmunk, *Tamias minimus atristriatus*) species. Based on current distribution and habitat requirements, three of these species have the potential to occur in the project area: Mexican spotted owl (*Strix occidentalis lucida*), Peñasco least chipmunk, and New Mexico meadow jumping mouse (*Zapus hudsonius luteus*). Species that are not expected to occur near or within the project area, due to the range of the species or lack of habitat, are assumed to be unaffected by the proposed action, and therefore are not carried forward in the analysis (see Appendix C). The Peñasco least chipmunk is a regional forester sensitive species, a state endangered species, and a candidate species for federal listing.

Please note that species that have not been observed or documented on or near the Lincoln National Forest, and that have no associated designated critical habitat on or near the forest, were removed from further analysis and are listed in Appendix C.

Table 3-26. Federally Listed Animal Species Known to Occur in the Lincoln National Forest

Common Name (Scientific Name)	Status*	Range or Habitat Requirements	Potential for Occurrence in Project Area
Least tern (*Sterna antillarum*)	Endangered	Seacoasts, beaches, bays, estuaries, lagoons, lakes and rivers, breeding on sandy or gravelly beaches and banks of rivers or lakes, rarely on flat rooftops of buildings.	Not documented to occur on or near the Lincoln National Forest
Mexican spotted owl (*Strix occidentalis lucida*)	Threatened with designated critical habitat	Mixed conifer forest between 8,000 and 9,400 feet.	Yes. Species is known to occur and has critical habitat within the project area.
Northern aplomado falcon (*Falco femoralis septentrionalis*)	Experimental Population, Non-Essential	Lower-elevational open desert scrub, white sands, and desert shrub. Habitat is variable throughout the species' range and includes palm and oak savannahs, and various desert grassland associations.	Not documented to occur on or near the Lincoln National Forest.
Yellow-billed cuckoo (*Coccyzus americanus*)	Threatened	Lower-elevational desert willow, perennial streams with full canopy, intact riparian vegetation. Use wooded habitat with dense cover and water nearby, including woodlands with low, scrubby vegetation, overgrown orchards, abandoned farmland, and dense thickets along streams and marshes. They nest in willows along streams and rivers, with nearby cottonwoods serving as foraging sites.	Not documented to occur on or near the Lincoln National Forest. No critical habitat designated on the Lincoln National Forest.
Peñasco least chipmunk (*Tamias minimus atristriatus*)	Candidate	High-elevation alpine and subalpine open meadows, talus slopes, open montane grassy areas.	Yes. Species is endemic above 8,000 feet in the Sacramento Mountains.
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)	Endangered with designated critical habitat	Wet meadows.	Yes. Species is known to occur and has critical habitat within the project area.

* U.S. Fish and Wildlife Service status definitions: **Endangered**: Any species considered by the U.S. Fish and Wildlife Service as being in danger of extinction throughout all or a significant portion of its range. **Threatened**: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. **Candidate**: Any species of animal or plant that is proposed for threatened or endangered status by the U.S. Fish and Wildlife Service.

Mexican spotted owl (*Strix occidentalis lucida*)

A detailed description of the affected environment for the Mexican spotted owl is provided in the wildlife biological evaluation (U.S. Forest Service 2018d); the following is a summary of that information.

The Mexican spotted owl inhabits mixed coniferous and pine/oak forests, canyons, desert caves, and riparian areas through the Southwest United States. On the Sacramento Ranger District, large oaks are typically associated with the mixed conifer habitat, while the oak component found within other habitat types tends to be primarily understory scrub oak. In New Mexico, Mexican spotted owls typically breed from March through August. They inhabit dense mixed conifer habitat zones with complex vegetation structure. They hunt at night for prey, including small mammals, lizards, and insects. The Mexican spotted owl population fluctuates in response to prey availability. Therefore, prey habitat, such as fallen logs, are an essential component of Mexican spotted owl habitat. Mexican spotted owls prefer to nest in similar mature or late successional mixed conifer habitat associations with a dense understory. They are cavity nesters, preferring holes that woodpeckers have already excavated in snags or other large trees. They require large patches of preferred habitat, with most territories ranging from 2.7 to 4.2 square miles. Adult Mexican spotted owls are faithful to their nesting sites, returning year after year to breed in the same location.

The project is within the Basin and Range-East Recovery Unit and is an important source population for other areas (U.S. Fish and Wildlife Service 2012). Mexican spotted owls occur in the isolated mountain ranges scattered across this recovery unit. They are most common in mixed conifer forest but are also found in ponderosa pine forest and pinyon-juniper woodland (Skaggs and Raitt 1988). The majority of known Mexican spotted owls are located on National Forest System lands, with some found on National Park Service and tribal lands.

Mexican spotted owl critical habitat is limited to specifically designated areas within mapped boundaries that meet the definition of protected and recovery habitat, as described in the final critical habitat rule (U.S. Fish and Wildlife Service 2004). The designated critical habitat areas for the Sacramento Ranger District are in mixed conifer forests. These sites are embedded within protected or recovery Mexican spotted owl habitats. Critical habitat is defined by primary constituent elements, which are physical and biological features necessary to ensure conservation of the species. The U.S. Fish and Wildlife Service (2004) identified the primary constituent elements in the August 2004 designation of Mexican spotted owl critical habitat. The purpose of habitat designations is to encourage, and move forest structure toward, conditions suitable for the Mexican spotted owl, along with improving conditions for Mexican spotted owl prey species.

On the Sacramento Ranger District, the primary constituent elements for Mexican spotted owl are found in mixed conifer forests. These fall within the Basin-Range East 1 critical habitat section and include the management objectives from the updated Mexican spotted owl recovery plan (U.S. Fish and Wildlife Service 2012). There are approximately 253,726 acres of designated Mexican spotted owl critical habitat in the Basin and Range-East Recovery Unit, with 100,965 acres located on the Sacramento Ranger District. There are 111,774 acres of Mexican spotted owl critical habitat within mixed conifer forests in the project area (Table 3-27).

Table 3-27. Mexican Spotted Owl Habitat Type and Number of Acres in the Project Area

Habitat	Acres
Protected activity center	43,400
Critical habitat	111,774

Mexican spotted owl critical habitat is limited to specifically designated areas within mapped boundaries. The designated area for the Sacramento Ranger District is mixed conifer forests. These sites are embedded within protected or recovery Mexican spotted owl habitats. These critical habitats contain primary constituent elements, which are physical and biological features necessary to ensure conservation of the species.

Primary constituent elements related to forest structure include:

- A range of tree species and tree sizes, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30 to 45 percent of which are large trees with a trunk diameter of 12 inches or more when measured at 4.5 feet from the ground (range of tree sizes);
- A shade canopy created by the tree branches covering 40 percent or more of the ground (canopy closure); and
- Large dead trees (snags) with a trunk diameter of at least 12 inches when measured at 4.5 feet from the ground (large snags).

Primary constituent elements related to the maintenance of adequate prey species include:

- High volumes of fallen trees and other woody debris (dead and downed woody debris);
- A wide range of tree and plant species, including hardwoods (plant species richness);
- Adequate levels of residual plant cover to maintain fruits and seeds, and allow plant regeneration (residual plant cover).

Steep-walled rocky canyonlands are typically found within the Colorado Plateau Ecological Management Unit but are also found in other ecological management units. Canyon habitat is used by owls for nesting, roosting, and foraging, and includes landscapes dominated by vertical-walled rocky cliffs within complex watersheds, including many tributary side canyons. These areas typically include parallel-walled canyons up to 1.2 miles in width (from rim to rim), with canyon reaches often 1.2 miles or greater, and with cool, north-facing aspects. The primary constituent elements related to canyon habitat include one or more of the following:

- Presence of water (often cooler and often providing higher humidity than the surrounding areas);
- Clumps or stringers of mixed conifer, pine-oak, pinyon-juniper, and/or riparian vegetation;
- Canyon walls containing crevices, ledges, or caves; and
- High percent of ground litter and woody debris.

Protected Activity Centers and Nest Core Areas

Protected activity centers are designated around recorded owl nest/roost sites and include a minimum of 600 acres. Protected activity centers are where Mexican spotted owls are known to occur per the definition of an owl site (U.S. Fish and Wildlife Service 2012). There are 78 protected activity centers in the project area and 122 established protected activity centers on the Sacramento Ranger District. Within protected activity centers, a nest core area is defined as the 100 acres surrounding a nest site or sites within a protected activity center. Vegetation thinning and prescribed burn treatments would be restricted in protected activity centers as detailed in the resource protection measures (see Section 2.2.5). Should any nest core areas be established during the implementation phase of the project, hand thinning treatments would be allowed following criteria developed by the U.S. Forest Service. Mechanical treatments, however, would require concurrence from the U.S. Fish and Wildlife Service and need to be within the guidelines of the recovery plan. Any treatments within nest cores would be highly limited and guided by reducing risk and improving sustainability of the nest core area.

Nesting Mexican spotted owls in the protected activity centers were located during monitoring completed in 2017 (U.S. Forest Service 2019). Approximately 7,945 acres of nest core areas occur within the project area. In the project area, there are eight reference protected activity centers (4,907 acres) and seven treatment protected activity centers (4,226 acres). Of the total Mexican spotted owl habitat in the project area, approximately 43,411 acres are designated as protected activity centers.

Mexican spotted owl surveys are conducted annually by Sacramento Ranger District and Rocky Mountain Research Station personnel. The monitoring determines occupancy and reproduction to help determine population trends for the district, as well as meeting the 2005 Biological Opinion for Reasonable and Prudent Measures. This level of monitoring fulfills the recommendations in the Mexican spotted owl recovery plan (U.S. Fish and Wildlife Service 2012). In 2017, the U.S. Forest Service visited 25 total protected activity centers during inventory and monitoring surveys. No young off the nest were found by the last visit. Monitoring included three inventories (U.S. Forest Service 2019). All the protected activity centers undergoing treatments in survey years (or as needed) within the project area would be monitored by Sacramento Ranger District personnel.

Recovery Habitat

Recovery habitat on the Sacramento Ranger District is also contained within the mixed conifer ecological response unit. Recovery habitat includes suitable habitat outside of protected habitat that owls use for foraging and dispersing. A subset of recovery habitat is also managed towards nest/roost replacement habitat. Recovery habitat includes mixed conifer forest, pine-oak forest, and riparian areas adjacent to or outside protected areas. These habitat areas are used by resident (i.e., territorial) owls for foraging, since the 600 acres recommended for protected activity centers include on average 75 percent of nighttime foraging locations of radioed birds (U.S. Fish and Wildlife Service 2012). The recovery areas also provide habitat for non-territorial birds (often referred to as ‘‘floaters’’), to support dispersing juveniles, and to provide replacement nest/roost habitat on the landscape through time.

Peñasco least chipmunk (*Tamias minimus atristriatus*)

A detailed description of the affected environment for the Peñasco least chipmunk is provided in the wildlife biological evaluation (U.S. Forest Service 2018d); the following is a summary of that information.

The Peñasco least chipmunk, a candidate species for listing under the Endangered Species Act, is endemic to the Sacramento Mountains in Lincoln and Otero Counties, New Mexico (Bailey 1913; Conley 1970; Sullivan 1985; Sullivan and Petersen 1988). In New Mexico, disjunct and isolated populations of the Peñasco least chipmunk occur in portions of the Sacramento and White Mountains, including James Canyon, Peñasco Canyon, and Sierra Blanca Peak (Findley and others 1975; Frey and others 2009; Sullivan and Petersen 1988). The historic habitats of the Sacramento Mountains population have mostly been eliminated and subsequently replaced by dense coniferous stands of young trees that are unsuitable for the Peñasco least chipmunk (Frey and Boykin 2007).

Threats to this species include drought, wildfire, and possible competition with the gray-footed chipmunk (New Mexico Department of Game and Fish 2016). However, the single greatest cause of decline of the Peñasco least chipmunk in the Sacramento Mountains is the loss, alteration, and fragmentation of mature ponderosa pine forests (Frey and Boykin 2007). In the absence of frequent surface fires, remaining suitable habitat of the Peñasco least chipmunk that was historically dominated by open ponderosa pine savannahs with understory grasses and forbs is now filled with dense in-growth of Douglas-fir and white fir (Allen and others 2002; Kaufmann and others 1998). Continued fire exclusion and suppression of fire in the Sacramento Mountains will further restrict the range of the subspecies and prevent the restoration of ponderosa pine and increase the risk of high-intensity fires (U.S. Fish and Wildlife Service 2015b). Moreover, the highly fragmented nature of its current distribution is a contributor to the vulnerability of this subspecies and increases the likelihood of very small, isolated populations being extirpated. As a result of this fragmentation, even if suitable habitat exists (or is restored) in the Sacramento Mountains, the likelihood of natural recolonization of historic habitat or population expansion from the White Mountains is extremely remote (U.S. Fish and Wildlife Service 2015b).

Frey and Hays (2017) reported that the last location where Peñasco least chipmunks were documented in the Sacramento Mountains, in 1966, is near the erosional gully in James Canyon adjacent to James Canyon Campground. Since the Peñasco least chipmunk has not been documented in the Sacramento Mountains since 1966, protection of any remaining habitat is critical. According to Frey and Hays (2017), the potential land cover suitable for Peñasco least chipmunk in the Sacramento Mountains showed that montane grasslands and ponderosa pine forests were restricted in distribution. None of the areas they visited in the field appeared to have appropriate habitat for Peñasco least chipmunk, as all lacked well-developed, native meadow and grassland vegetation communities.

New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)

A detailed description of the affected environment for the New Mexico meadow jumping mouse is provided in the wildlife biological evaluation (U.S. Forest Service 2018d); the following is a summary of that information.

The New Mexico meadow jumping mouse is endemic to New Mexico, Arizona, and a small area of southern Colorado (Hafner and others 1981; Jones 1981). The New Mexico meadow jumping mouse is a habitat specialist (Frey 2006). It nests in dry soils, but uses moist, streamside, dense riparian/wetland vegetation up to an elevation of about 8,000 feet (Frey 2006). Because the New Mexico meadow jumping mouse requires such specific suitable habitat conditions, populations have a high potential for extirpation when habitat is altered or eliminated. When localities are extirpated there is little or no opportunity for natural recolonization of the area due to the species' limited dispersal capacity and the current conditions of isolated populations.

Threats to the New Mexico meadow jumping mouse include impacts from livestock grazing (i.e., loss of native riparian vegetation), water management and use (which causes vegetation loss from mowing and drying of soils), lack of water due to drought, and wildfires. Additional sources of habitat loss are likely to occur from scouring floods, loss of beaver ponds, highway reconstruction, coalbed methane development, and unregulated recreation. These multiple sources of habitat loss are not acting independently, but likely produce cumulative impacts that magnify the effects of habitat loss on the small, remaining jumping mouse populations.

In 2005, the New Mexico meadow jumping mouse was captured at two localities within the Sacramento Mountains (Frey 2005). In 2010, the New Mexico meadow jumping mouse continued to occupy at least one of the 2005 localities (U.S. Forest Service 2010a). In 2012, the subspecies was detected at two additional sites (U.S. Forest Service 2012a). The only valid surveys for New Mexico meadow jumping mouse in the Sacramento Mountains have been restricted to the watersheds of the Rio Peñasco and Sacramento River (Frey 2013, 2016; Frey and Malaney 2009; Forest Service surveys cited in U.S. Fish and Wildlife Service 2014a, 2014b, 2016). In 2016, Dr. Frey stated that of the 20 populations known to have existed in the Sacramento Mountains, recent surveys have verified persistence of only a single population, which exists as a small, isolated population inside a remote livestock grazing exclosure (Frey 2016; Frey and Malaney 2009; U.S. Fish and Wildlife Service 2014b, 2016). This decline indicates severe ongoing threats to the species in the Sacramento Mountains (Frey 2016).

New Mexico meadow jumping mouse critical habitat within the project area comprises approximately 1,082 acres within the project area (Table 3-28, Figure 3-30).

Table 3-28. New Mexico Meadow Jumping Mouse Critical Habitat Acreage within Each Ecological Response Unit in the Project Area

Ecological Response Unit	Acres
Herbaceous Wetland	128
Mixed Conifer (Frequent Fire)	405
Mixed Conifer (w/ Aspen)	65
Montane / Subalpine Grassland	387
Ponderosa Pine Forest	97
Total	**1,082**

The critical habitat primary constituent elements consist of the following:

- Flowing water that provides saturated soils throughout the New Mexico meadow jumping mouse's active season that supports tall (average stubble height of herbaceous vegetation of at least 27 inches) and dense herbaceous riparian vegetation (cover averaging at least 24 inches) composed primarily of sedges (*Carex* spp. or *Schoenoplectus pungens*) and forbs, including, but not limited to, one or more of the following associated species: spikerush (*Eleocharis macrostachya*), beaked sedge (*Carex rostrata*), reed canarygrass (*Phalaris arundinacea*), rushes (*Juncus* spp. and *Scirpus* spp.), and numerous species of grasses such as bluegrass (*Poa* spp.), slender wheatgrass (*Elymus trachycaulus*), brome (*Bromus* spp.), foxtail barley (*Hordeum jubatum*), or Japanese brome (*Bromus japonicas*), and forbs such as water hemlock (*Cicuta douglasii*), field mint (*Mentha arvense*), asters (*Aster* spp.), or cutleaf coneflower (*Rudbeckia laciniata*); and
- Sufficient areas of 5.6 to 15 miles along a stream, ditch, or canal that contain suitable or restorable habitat to support movements of individual New Mexico meadow jumping mice; and
- Include adjacent floodplain and upland areas extending approximately 330 feet outward from the water's edge (as defined by the bankfull stage of streams).

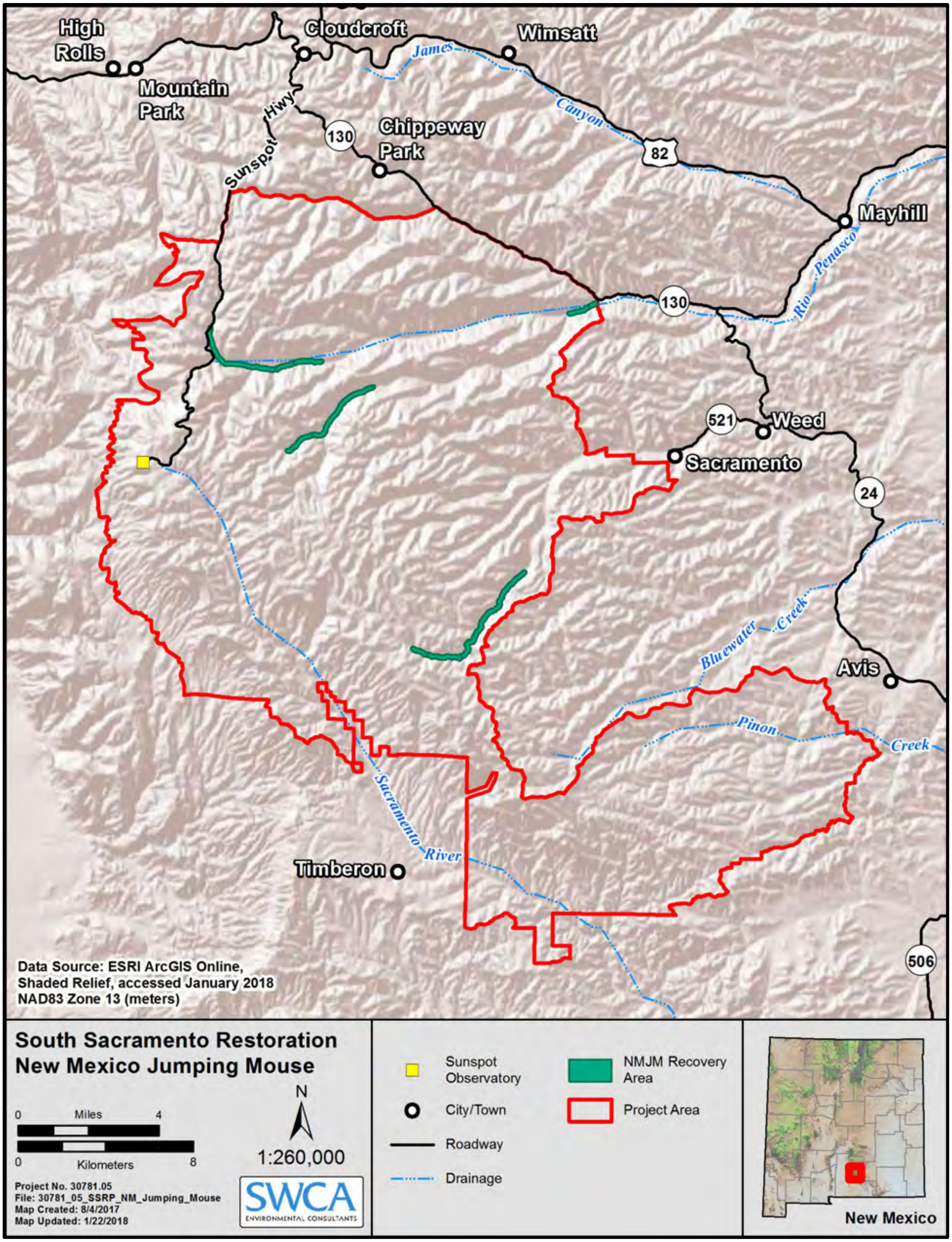

Figure 3-30. New Mexico meadow jumping mouse habitat within the South Sacramento Restoration Project Area.

Incomplete or Unavailable Information

Data and information about each species, population status, key habitat features, and threats were gleaned from surveys from the project area and data and research specific to the species in other parts of New Mexico or the Southwest.

3.5.2 Methodology and Assumptions Used for Analysis

This analysis includes effects on species individuals and local populations as well as species habitat, and effects on critical habitat (including primary constituent elements).

The impact analysis for federally listed species is based on the following:

- a determination of the potential for any given federally listed species to occur within any planned site-specific restoration activities,
- a determination of the potential for restoration activities (i.e., vegetation thinning treatments and associated activities) to affect any individuals of any federally listed species within a planned site-specific restoration area, and
- the assumption that the project resource protection measures would be employed to keep project actions from adversely impacting any federally listed animals (see Section 2.2.5).

For the analysis of direct and indirect effects, short-term impacts are impacts lasting up to 2 years from when the action was implemented, and long-term impacts are impacts lasting longer than 2 years. The spatial boundary used for analysis in this report varies, depending on the species or category of species and is defined within the discussion of impacts within each species evaluation addressed below.

A biological assessment for the South Sacramento Restoration Project is currently underway, and any potential determinations made, and information about, each of the federally listed fauna species within this environmental impact statement represents the best available science and relevant scientific information, and where appropriate, acknowledges incomplete or unavailable information, scientific uncertainty, and risk. Principal information sources for federally listed species and their habitats within the project area include the Forest Service data on such species and their habitats within or adjacent to the project area, the U.S. Fish and Wildlife Service's Information for Planning and Consultation database (see Appendix C), the Biota Information System of New Mexico database (2018) maintained by the New Mexico Department of Game and Fish, Natural Heritage New Mexico (a division of University of New Mexico's Museum of Southwestern Biology), New Mexico Energy, Minerals and Natural Resources Department Forestry Division (2017), the New Mexico Rare Plant Technical Council (1999), the Forest Service (U.S. Forest Service 2012b), and specific documents that contain appropriate survey and ecological information on particular federally listed plant species that may occur within or adjacent to the project area.

3.5.3 Environmental Consequences

Mexican Spotted Owl

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on Mexican spotted owl habitat or population trends because proposed project activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. However, the vegetation trends previously described would continue to cause a decline in the quality of mature, mixed conifer forest habitat for this species. Density-related tree mortality in the larger trees (600 to 900 trees per acre) would be expected to continue. Remaining trees would remain growth suppressed, causing a further decline in the largest, most mature trees and a shift toward more seedlings and saplings. As the larger trees continue to die and fall over prematurely, there would be a loss of large overstory canopy cover and a decline in the average tree sizes and ages. The imbalance of age diversity and a stand density index approaching or beyond the zone of imminent mortality threaten the vitality of the vegetative zone and its ecological dependents such as the Mexican spotted owl. Thus, the imbalance in proportions of small young trees of vegetation structural stage classes 2 to 3 to large mature trees of vegetation structural stage classes 5 to 6 would continue to be significant. In addition, the biggest threat to the Mexican spotted owl has been identified as catastrophic wildfire, and this would remain a major threat to the species under the no action alternative.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term direct adverse effects on Mexican spotted owls in the form of habitat disturbance during project implementation. Vegetation thinning treatments may directly affect individual Mexican spotted owls, by temporarily reducing grass/forb habitat and by introducing loud noises from machinery and human entry into areas, but these impacts are expected to be short term. Mexican spotted owls are known to have high site fidelity in established territories and short-term impacts may disrupt normal behavioral patterns, such as breeding, foraging, etc., and may not be avoidable. Prescribed fire could have a direct impact to Mexican spotted owl and indirect impacts through a temporary loss of the grass/forb primary constituent element. These potential adverse effects would be partially mitigated through the application of resource protection measures (Wildlife-11) in Section 2.2.5, except where treatment is proposed in specific protected activity centers. In the long term, vegetation treatments and prescribed fire would improve the health and resiliency of mixed conifer habitats, thereby maintaining or increasing suitable habitat for Mexican spotted owls.

Other direct impacts to Mexican spotted owl, such as human disturbance and noise disruptions, would be localized and short term, resulting from crews and equipment during project implementation. Infrequent, noise-producing activities are generally assumed to have relatively little long-term impact on spotted owls. However, in the short term, owls will react to noise disturbances by changing behavior and/or flushing from their perches. These behavioral responses may alter nesting and roosting activities, thus increasing vulnerability to predators and heat-related stress. Noise impacts are most likely to occur at the level of individual owls and/or protected activity centers, particularly during breeding season. For most of the proposed project area, these impacts would be avoided with implementation of resource protection measures (Wildlife-11). If non-breeding is inferred or confirmed that year per the accepted survey protocol, restrictions on noise disturbances could be relaxed depending on the nature and extent of the proposed disturbance. There are expected to be short-term adverse impacts in the PACs specifically identified for treatment.

Effects from Vegetation Thinning

The proposed vegetation thinning activities would treat approximately 15,300 acres of Mexican spotted owl protected activity center habitat. These activities would contribute to a more diverse forest structure in the project area and are intended to shift the mixed conifer ecological response unit toward meeting conditions more desirable for the persistence Mexican spotted owl habitat, as well as being more resilient to wildfire and insect and disease infestations. These changes include trending toward more open states of mature trees, while limiting the acreage of medium-sized trees that exceed the desired condition from the recovery plan in terms of basal area. Removal of some large trees could have short-term impacts on Mexican spotted owl habitat. Suitable nest tree and prey habitat would be lost by removing large trees; however, large trees would only be removed under the appropriate seasonal conditions when large tree mortality would be sporadic over the landscape. Overall, with implementation of resource protection measures (Veg-12, Veg-13, Rx-3, Wildlife-8, Wildlife-11), the treatments are designed to increase the amount of nest/roost habitat found within the project area, resulting in a long-term beneficial impact to Mexican spotted owls.

Mechanical thinning and the use of fire would remove shrubs and small trees, allowing for greater sunlight to the understory. Increased plant production and diversity would support an increased prey base for owl foraging and a long-term improvement of habitat conditions. These treatments should also help reduce high-severity fire effects across broader forest landscapes and help protect Mexican spotted owl protected activity centers, suitable habitats, and suitable nesting/roosting habitat locations from future stand-replacing wildland fires, and enhance landscape-level forest resiliency to climate variability, which would help restore a healthy fire-adapted ecosystem in Mexican spotted owl habitat. No Mexican spotted owl nest cores would be treated mechanically without concurrence from the U.S. Fish and Wildlife Service and any treatments would be within the guidelines of the recovery plan; any treatments within nest cores would be highly limited and would comply with management guidelines and resource protection measures (Wildlife-11). If any new nest core areas are established, no mechanical treatments would be allowed within the nest core area without concurrence from the U.S. Fish and Wildlife Service.

Effects from the Use of Fire

Under the proposed action, approximately 34,200 acres of prescribed fire would occur within Mexican spotted owl protected activity centers. The goal of these treatments is to create uneven-aged stand structure with clumpy interlocked crown forests with small openings intermixed and to restore the natural functions over the landscape. Prescribed fire could directly impact individual Mexican spotted owls in the short term from burning, smoke, noise, people, etc., which may adversely impact foraging, breeding, and nesting behaviors. However, prescribed fires in protected activity centers would be low in severity and intensity, and fire lines would not be built within nest/roost cores or in protected activity centers (established roads or skid roads could be used for fire line, but no new fire line construction would occur). All management guidelines and resource protection measures (Wildlife-7, Wildlife-8, Wildlife-11) would be followed for prescribed burns.

Prescribed fire could result in indirect impacts to Mexican spotted owk through the loss of habitat. The initial, first-year reduction in understory vegetation would increase prey vulnerability and temporarily increase foraging opportunities for Mexican spotted owls. Following prescribed fire, the ground vegetation would rapidly recover. Plant diversity, prey habitat, and prey abundance would be expected to increase, and the burning and thinning of current even-aged stands would help create uneven-aged forest conditions which would enhance Mexican spotted owl habitat and provide a long-term benefit to the species. Resource protection measures would be followed to prevent disturbance of nesting pairs of Mexican spotted owl, and in the long term, treatments are expected to improve foraging, nesting, and roosting habitat.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact Mexican spotted owl in the form of disturbances from crews and equipment during project implementation. These impacts would be localized and short term, and resource protection measures (Wildlife-6, Wildlife-11), such as buffer zones, would minimize potential disturbance or displacement concerns within Mexican spotted owl habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact Mexican spotted owl. Indirect impacts to Mexican spotted owl from consuming prey in treated areas are not expected to have a measurable effect on Mexican spotted owl because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017c). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would result in a long-term improvement in habitat conditions.

Effects from Other Restoration Methods

Other restoration methods, such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Mexican spotted owl habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species. These restoration methods may lead to displacement of Mexican spotted owl, but these restoration methods would be localized and short term.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require Forest Service authorization through existing contracting or special use permitting processes. Direct effects, such as noise disturbance, on Mexican spotted owl are expected; however, resource protection measures (Wildlife-11) are in place to minimize impacts to Mexican spotted owl individuals, breeding pairs, and habitat. However, indirect impacts such as displacement of Mexican spotted owl may occur. Any indirect impacts to Mexican spotted owl from special use authorizations would be short term, and Mexican spotted owl could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. Indirect impacts to Mexican spotted owl, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Noise impacts during road management activities could displace Mexican spotted owls as well as disturb nesting activity. However, Mexican spotted owl may be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Human disturbance to Mexican spotted owl would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed. Further, resource protection measures (Road-15, Wildlife-11) are in place to help minimize impacts to individual and local populations during road management activities.

Cumulative Effects for Mexican Spotted Owl

This section addresses cumulative effects of past, present, and reasonably foreseeable non-federal actions that may affect Mexican spotted owl individuals and their habitat. See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on threatened and endangered species. The spatial boundary for analyzing the cumulative effects is the Sacramento Ranger District, as it represents a reasonable region in which the wildlife species, when assessed in combination

with other cumulative actions, would be impacted if the proposed project were implemented.
The effects analysis applies to all ecological response units. The temporal boundary for analyzing the cumulative effects is 30 years, because restoration methods are anticipated to have taken effect in that time period.

In addition to the actions listed in Table 3-1, past, present, and reasonably foreseeable non-federal actions within the range of the Mexican spotted owl within or near the boundaries of the Sacramento Ranger District include county and state road maintenance and state, county, or local wildfire-related actions, and timber activities, as well as livestock grazing. Private lands within the known range of the Mexican spotted owl near the analysis area have been owned and managed by various landowners since the previous century. These activities are expected to continue and may inhibit foraging of the Mexican spotted owl and may slightly increase the chances of vehicles strikes during the 2 hours after sunrise and 2 hours before sunset when owls are most active.

Collectively, these uses on non-federal lands have the potential to have a cumulative effect on the Mexican spotted owl and its habitat on a landscape level. Any cumulative impacts to Mexican spotted owls are not likely to adversely impact forest-wide population or habitat trends. Impacts on individuals are expected to be short term. Given the size and scope of the proosed action combined with the effects of past, present, and reasonably forseeable activiites in the analysis area, it is concluded that these cumulative effects would not limit the recovery of the Mexican spotted owl and its critical habitat on federal lands.

Effects Summary

The proposed action would result in direct effects on Mexican spotted owls. However, resource protection measures would ensure that planning and implementation of any project treatment activities would include pre-treatment evaluations and field surveys as needed for individuals of this species on all planned treatment locations prior to any treatment activities. In addition, constant communication with the U.S. Fish and Willdlife Service on proposed activities and observed effects in protected activity centers would be maintained during the implementation phase. If any new individuals of this species are found within any planned treatment area, excluding specific treatment in protected activity centers, all occupied sites would be protected by a protected activity center buffer in accordance with the Mexican spotted owl management guidelines and desired conditions section, as well as any other resource protection measures that may be needed to protect all individuals of this species from all types of treatment activities.

The proposed action would likely disturb nesting pairs of Mexican spotted owl in the short term, although long-term benefits would result in improved foraging, nesting, and roosting habitat for the species. Resource protection measures would ensure that planning and implementation of any project treatment activities will include pre-treatment evaluations and field surveys as needed for individuals of this species on all planned treatment locations prior to any treatment activities. The proposed action would have short-term adverse effects within the protected activity centers that would receive proposed treatments; these effects are currently being analyzed. The proposed action would retain and, in most cases, create the habitat attributes the owl and its prey base need (e.g., large snags, downed woody material, conditions moving toward old-growth type stages). Based on the analysis above, the activities of the proposed action are consistent with the recommendations in the Forest Plan and Forest Plan Amendment, as well as with previous treatments that have had concurrence from the U.S. Fish and Wildlife Service on a ***may affect, and are likely to adversely affect*** determination (#2-22-98-I-248, #2-22-03-I-699, and #22420-2009-I-0080). Detailed examination and consideration of impacts to these species are still being conducted in the biological assessment; therefore, this effect determination could be revised as this analysis continues.

The activities of the proposed action ***may affect and are likely to adversely modify*** Mexican spotted owl designated critical habitat. This preliminary determination is a result of some of the treatments proposed to occur within specific protected activity centers that may destroy a primary constituent element or modify it to a condition where Mexican spotted owls cannot use it in the short term—although it is expected that the proposed treatments would result in long-term benefits in improved forest resiliency, habitat enhancement, and increased primary constituent elements of critical habitat. The proposed action activities would strive to retain or increase adequate primary constituent elements in the remainder of the proposed project area for the Mexican spotted owl, based on Forest Plan standards and guidelines, and in fact are expected to provide recruitment of primary constituent elements. The resource protection measures implemented under the proposed action are designed to help protect and produce an increase in primary constituent elements. Detailed examination and consideration of impacts to this species are still being conducted in the biological assessment; therefore, this effect determination could be revised as agency consultation continues.

Peñasco least chipmunk (*Tamias minimus atristriatus*)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on Peñasco least chipmunk habitat or population trends because proposed project activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. However, the vegetation trends previously described would continue to cause a decline in the quality of mature, mixed conifer forest open grassy understory and grassy meadow habitat for this species. Density-related tree mortality in the larger trees (600 to 900 trees per acre) would be expected to continue. Remaining trees would remain growth suppressed, causing a further decline in the largest, most mature trees and a shift toward more seedlings and saplings. As the larger trees continue to die and fall over prematurely, there would be a loss of large overstory canopy cover and a decline in the average tree sizes and ages. The imbalance of age diversity and a stand density index approaching or beyond the zone of imminent mortality threaten the vitality of the vegetative zone and its ecological dependents such as the Peñasco least chipmunk. Thus, the imbalance in proportions of small young trees (of vegetation structural stage classes 2 to 3) to large mature trees (of vegetation structural stage classes of 5 to 6) would continue to be significant. The further decrease in open grassy montane meadows would continue. There would be plenty of downed logs and other cover structures, which are key habitat requirements for the Peñasco least chipmunk.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on the Peñasco least chipmunk in the form of habitat disturbance during project implementation. Based on the overall benefits of the proposed action—i.e., reducing the potential for uncharacteristic high-severity fires and improving forest health, and increasing open grassy understory and grassy montane meadows—habitat for the Peñasco least chipmunk is assumed to be improved and/or restored from the proposed project. It is possible that the creation of diverse habitat features could result in the species becoming reestablished in the project area. With the implementation of avoidance buffers and other design features in any remnants of suitable or reasonably suitable habitat, minimal impacts are anticipated for the Peñasco least chipmunk individuals as a result of activities associated with the proposed action. Resource protection measures (Wildlife-2 through Wildife-5, Wildlife-7, Wildlife 8, and Wildlife-10) for wildlife species and specifically for habitat of the Peñasco least chipmunk (Wildlife-13) would prevent or minimize the potential for disturbance of habitat and are part of the treatment planning process to avoid adverse actions that may affect this species.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to the Peñasco least chipmunk and indirect impacts through loss of habitat, considering the species prefers habitats with mature ponderosa pine and ponderosa-mixed conifer forests. The thinning treatments involve free thinning of all tree sizes, thin from below, and group selection with matrix thinning between groups. Thinning from below would remove the smallest trees in the understory and less of the live overstory canopy. The result would be a reduction in tree density, canopy cover, and shading of the forest floor. Direct impacts of these treatments would reduce the amount of stand density and would affect canopy requirements of Peñasco least chipmunk habitat. However, the canopy openings created by the treatments would also benefit the Peñasco least chipmunk. Resource protection measures and timing restrictions to protect Mexican spotted owl and Sacramento Mountains salamander on these sites by retaining dense clumps of trees and relatively higher overstory canopy cover would also benefit the Peñasco least chipmunk. The retention of open grassy habitats interspersed with large cover structures, such as boulders and downed woody material, is an important habitat component for this species. The potential habitat disturbance by the use of heavy equipment may cause a decrease in species numbers in a particular area, and the chipping or mastication within habitat may alter fauna within the area. Vegetation treatments associated with the project may increase some sedimentation within Peñasco least chipmunk habitat and this may create a positive or negative short-term response from the fauna within the area.

Within a year following thinning treatments, there is expected to be a substantial increase in the abundance of grasses and forbs, especially in the small canopy gaps. Downed logs and wood are key habitat features and thinning would not remove existing downed logs but would generate additional downed logs and woody material (tree stems and branches). There would be sufficient downed logs and woody material to maintain or enhance Peñasco least chipmunk habitat in the area. Snags are considered future replacement downed logs, as they eventually fall to the ground. Resource protection measures are also built into the project and address the need to retain large trees and snags to provide wildlife habitat. The snags retained within the project area, combined with the snags in adjacent untreated forest stands, would likely result in continuation of snag abundance within suitable Peñasco least chipmunk habitat. Thus, large logs and downed wood should continue to remain abundant in the future as snags fall to the ground over time. With the implementation of avoidance buffers and other design features in any remnants of suitable or reasonably suitable habitat, minimal impacts are anticipated for Peñasco least chipmunk individuals as a result of activities associated with the proposed action. Resource protection measures for wildlife species, and specifically for habitat of the Peñasco least chipmunk, would prevent or minimize the potential for habitat disturbance.

Effects from the Use of Fire

The restoration methods and associated activities of the project could have a direct impact to Peñasco least chipmunk and indirect impacts through loss of habitat, considering the species prefers mature ponderosa pine and ponderosa-mixed conifer forests. All prescribed burn treatment areas within Peñasco least chipmunk habitat would only be low-intensity surface burns. Direct impacts of prescribed burning would temporarily reduce the open grassy habitats interspersed with large cover structures for the first year. However, the mosaic pattern of the burn would also open some of the canopy within habitat and help create meadow grassland structure. Prescribed fire would lead to downed woody material recruitment that the Peñasco least chipmunk uses and would also offset any potential loss of existing downed woody material and improve the cover and foraging habitat of the Peñasco least chipmunk. Grasses and forbs would rapidly grow in and replenish the soil moisture, along with the additional downed wood left from thinning. Within 5 years, there would additionally be new tree seedlings and more mature plants on the forest floor, substantially improving the habitat conditions for the Peñasco least chipmunk.

Indirect effects may occur in the form of habitat loss through erosion, sedimentation, or the use of heavy equipment causing soil compaction. Although heavy equipment use within the project area is not likely to have a direct impact to the Peñasco least chipmunk (due to avoidance and timing of implementation), heavy equipment used to implement the project could lead to an increase in site disturbance, which may lead to soil compaction, erosion, and the introduction and/or spread of nonnative invasive species.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact Peñasco least chipmunk habitat in the form of ground-disturbing activities occurring during project implementation. Resource protection measures during implementation would minimize potential disturbance concerns within Peñasco least chipmunk habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact Peñasco least chipmunk. Indirect impacts to Peñasco least chipmunk from consuming insects in treated areas are not expected to have a measurable effect on Peñasco least chipmunk because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to Peñasco least chipmunk, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures designed to avoid and protect the species (see Section 2.2.5). Long-term indirect impacts of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Peñasco least chipmunk habitat to the adverse impacts of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require Forest Service authorization through existing contracting or special use permitting processes. No direct effects on Peñasco least chipmunk are expected as resource protection measures (see Section 2.2.5) would be followed for wildlife. However, indirect impacts such as displacement of Peñasco least chipmunk may occur. Any indirect impacts to Peñasco least chipmunk from special use authorizations would be short term, and Peñasco least chipmunk could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impacts to Peñasco least chipmunk are anticipated, as these activities would not be long term in nature. Indirect impacts to Peñasco least chipmunk, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation will be needed throughout the project area to support the proposed restoration treatments. Road management activities associated with the proposed action may temporarily displace Peñasco least chipmunk in the short term. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. However, Peñasco least chipmunk may be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Human disturbance to Peñasco least chipmunk would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Cumulative Effects for Peñasco Least Chipmunk

This section addresses cumulative effects of past, present, and reasonably foreseeable non-federal actions that may affect Peñasco least chipmunk individuals and their habitat. See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on threatened and endangered species. The spatial boundary for analyzing the cumulative effects is the Sacramento Ranger District, as it represents a reasonable region in which the wildlife species, when assessed in combination with other cumulative actions, would be impacted if the proposed project were implemented. The effects analysis applies to all ecological response units. The temporal boundary for analyzing the cumulative effects is 30 years, because restoration methods are anticipated to have taken effect in that time period.

In addition to the actions listed in Table 3-1 above, past, present, and reasonably foreseeable non-federal actions within the range of the Peñasco least chipmunk within or near the analysis area boundaries on the Sacramento Ranger District include county and state road maintenance and state, county, or local wildfire-related actions, and timber activities, as well as livestock grazing. Private lands within the known range of the Peñasco least chipmunk near the analysis area have been owned and managed by various landowners since the previous century. These activities are expected to continue and may inhibit nesting or foraging of the Peñasco least chipmunk.

Collectively, these uses on non-federal lands have the potential to have a cumulative effect on the Peñasco least chipmunk and its habitat on a landscape level. Any cumulative impacts to the Peñasco least chipmunk are not likely to impact the forest-wide population or habitat trends. Impacts would be short term and temporary. Resource protection measures would minimize impacts to the Peñasco least chipmunk when site-specific treatments for the South Sacramento Restoration Project occur (measures Wildlife-3, Wildlife-7, Wildlife-8, Wildlife-13). To the best of our knowledge, actions that are reasonably certain to occur on non-federal land parcels are expected to remain the same. Given the size and scope of the current analysis, it is concluded that these cumulative effects shall not limit the recovery of the Peñasco least chipmunk on federal lands.

Effects Summary

Although there is an overall lack of suitable habitat for the Peñasco least chipmunk in the Sacramento Mountains, recommendations for ponderosa pine habitat restoration, montane meadow restoration, and reintroduction of the species have been documented over the last 20-plus years. The proposed action includes forest restoration within ponderosa pine habitat and along with reintroduction of the species in areas of suitable habitat in the Sacramento Mountains, these actions could enhance the possibility of species survival within its historic range. In addition, further surveys should be conducted for the Peñasco least chipmunk in the Sacramento and White Mountains.

The proposed action, which includes Forest Plan amendments to allow the project to be implemented as designed, would not result in any direct effects on Peñasco least chipmunk individuals because no habitat in the project area is known to be occupied based on the last several decades of survey, and resource protection measures would be implemented if treatments were occurring in suitable habitat (measure Wildlife-13). With the implementation of avoidance and other design features in any remnants of suitable or reasonable habitat, no direct effects are anticipated for the Peñasco least chipmunk individuals as a result of activities associated with the proposed action. The proposed action would reduce the adverse effects of historic forest management that are causing declines in the health and productivity of the project area's forests, as well as the habitat of this and other native wildlife species. Based on the analysis above, the activities of the proposed action are not likely to jeopardize Peñasco least chipmunk individuals and their habitat located within the project area. Detailed examination and consideration of impacts to these species are still being conducted in the biological assessment; therefore, this effect determination could be revised as agency consultation continues.

New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on New Mexico meadow jumping mouse habitat or population trends because proposed project activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. However, the vegetation trends previously described would continue to cause a decline in the quality of mature, mixed conifer forest habitat and continue encroachment of woody species into the riparian meadows and habitat for this species.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on the New Mexico meadow jumping mouse in the form of upslope activities that may result in sedimentation and increased run-off during and immediately after project implementation. Proposed activities may retain the key habitat requirements for the New Mexico meadow jumping mouse as much as possible to maintain habitat suitability. However, some treatment activities may occur when the ground surface and soils are wet. During these periods, potential adverse effects would be mitigated through the application of the resource protection measures described in Section 2.2.5. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve, and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to the New Mexico meadow jumping mouse and indirect impacts through loss of habitat, considering the species prefers dense riparian/wetlands and meadow habitats within mature ponderosa pine, dry mixed conifer, and mixed conifer with aspen forest ecological response units. The thinning treatments involve free thinning of all tree sizes, thin from below, and group selection with matrix thinning between groups. Thinning from below would remove the smallest trees in the understory and fewer of the live overstory canopy. The result would be a reduction in tree density, canopy cover, and shading of the forest floor. Direct impacts of these treatments would reduce the amount of stand density and could affect the species along the margins of occupied habitat. However, reduction of stand density would also benefit the New Mexico meadow jumping mouse by increasing nesting habitat.

With the exception of thinning trees that encroach on riparian areas and meadows, these activities would not take place in New Mexico meadow jumping mouse habitat and these treatments would likely protect New Mexico meadow jumping mouse habitat from the adverse effects from severe post-wildfire flooding. Resource protection measures and timing restrictions to protect Mexican spotted owl and Sacramento Mountains salamander on these sites, by retaining dense clumps of trees and relatively higher overstory canopy cover, would also benefit the New Mexico meadow jumping mouse. The retention of riparian communities and adjacent meadows is an important habitat component for this species.

The potential habitat disturbance by the use of heavy equipment may cause a decrease in species numbers in a particular area, and the chipping or mastication within habitat may alter fauna within the area. Ground disturbance associated with these activities would potentially impact New Mexico meadow jumping mouse individuals and critical habitat. Adult New Mexico meadow jumping mice occupying an area during the active period are most likely to flee and may change behavior to avoid noise and ground-disturbing activities. Even though riparian areas would be avoided, heavy equipment could crush nests or cause the abandonment of young. If work takes place outside the active period these effects would be avoided. However, it is possible that direct effects on the New Mexico meadow jumping mouse may still occur because treatment activities during hibernation may disturb hibernating individuals. Critical habitat may also be adversely impacted over the short term. Even though riparian areas would be avoided, impacts such as heavy equipment crushing riparian vegetation within critical habitat may still occur.

Indirect impacts of vegetation treatments associated with the project may increase some sedimentation within New Mexico meadow jumping mouse habitat, and this may impact occupied or suitable habitat for the species. In the Crisp protected activity center, which is directly upslope from the Agua Chiquita population of the New Mexico meadow jumping mouse, timber thinning and burning would increase hydrological surface and subsurface flows. This in turn would increase the likelihood of additional sedimentation and ash flow into occupied and/or critical habitat. Additional indirect effects from sedimentation may result from alterations to hydrology, diversion of water, unnatural chemical spills, and the use of heavy equipment in or adjacent to suitable or occupied and/or critical habitat. However, resource protection measures for wildlife and aquatic management zones are in place to minimize potential impacts from project activities in suitable, occupied, or critical habitat.

<u>Effects from the Use of Fire</u>

The restoration methods and associated activities of the project could have a direct impact to New Mexico meadow jumping mouse and indirect impacts through loss of habitat, considering the species prefers dense riparian/wetlands and meadow habitats within mature ponderosa pine, dry mixed conifer, and mixed conifer with aspen forest forests. All prescribed burn treatment areas within and adjacent to New Mexico meadow jumping mouse habitat (and critical habitat) would only be low-intensity surface burns. Direct impacts of prescribed burning would temporarily reduce the soil moisture available in nesting habitat for the New Mexico meadow jumping mouse within the first year. In addition, for the first couple of years there would be increased sedimentation and ash flow into the riparian area and streams until the grasses and forbs grow back. The mosaic pattern of the burn would also open some of the canopy within occupied habitat, which will allow for the return of grassy meadow habitat for nesting. Grasses and forbs would rapidly grow in and replenish the soil moisture, along with the additional downed wood left from thinning in the adjacent uplands. The burning prescriptions will primarily focus on removing small-diameter trees, occasionally removing larger size classes. Within 5 years, there would additionally be new tree seedlings and more mature plants in the adjacent uplands.

The potential habitat disturbance by the use of heavy equipment may cause a decrease in species numbers in a particular area and may alter fauna within the area. Ground disturbance associated with these activities will have effects on New Mexico meadow jumping mouse. Adult New Mexico meadow jumping mice occupying an area during the active period are most likely to flee and may change behavior to avoid noise and ground-disturbing activities. Even though riparian areas would be avoided, heavy equipment could cause crushing of nests or abandonment of young. If work takes place outside the active period, these effects would be avoided. However, it is possible that direct effects on the New Mexico meadow jumping mouse may still occur because treatment activities during hibernation may disturb hibernating individuals.

Indirect effects may occur in the form of habitat loss from the use of heavy equipment causing disturbance to meadow habitat areas for New Mexico meadow jumping mice, which may cause a decrease in species numbers in nesting habitats. Resource protection measures and timing restrictions are in place to protect Mexican spotted owl and Sacramento Mountains salamander on these sites by retaining dense clumps of trees and relatively higher overstory canopy cover to provide adequate shading on the forest floor. These resource protection measures will additionally protect the New Mexico meadow jumping mouse. Based on the overall benefits of the proposed action, i.e., reducing the potential for uncharacteristic high-severity fires and improving forest health, habitat for the New Mexico meadow jumping mouse is assumed to be improved and/or restored under the proposed action.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact New Mexico meadow jumping mouse habitat in the form of ground-disturbing activities occurring during project implementation. Resource protection measures during implementation would minimize potential disturbance concerns within New Mexico meadow jumping mouse habitat. Herbicide treatments would be applied directly to juniper and oak sprouts as opposed to broadcast treatments. However, herbicides are not expected to directly impact New Mexico meadow jumping mouse because herbicide treatments would not be applied within or near any New Mexico meadow jumping mouse occupied sites within riparian areas, rivers, streams, springs, wetlands, wet meadows, canals, ditches, etc.

Indirect impacts to New Mexico meadow jumping mouse from consuming insects in treated areas are not expected to have a measurable effect on New Mexico meadow jumping mouse because herbicide treatments would not be applied within or near any New Mexico meadow jumping mouse occupied sites. In addition, only U.S. Environmental Protection Agency registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017b). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to New Mexico meadow jumping mouse, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Direct impacts from herbicide treatments are not expected to impact New Mexico meadow jumping mouse critical habitat because herbicide treatments would not be applied within or near any New Mexico meadow jumping mouse critical habitat (riparian areas, rivers, streams, springs, wetlands, wet meadows, canals, ditches, etc.). Indirect impacts to New Mexico meadow jumping mouse critical habitat in treated areas are not expected to have a measurable effect because herbicide treatments would not be applied within or near any New Mexico meadow jumping mouse critical habitat.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures designed to avoid and protect the species. Direct impacts to critical habitat from other restoration methods are unlikely to have an adverse impact due to resource protection measures designed to avoid and protect the species and its critical habitat. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species and critical habitat by restoring watershed and hydrologic function, which would improve the resistance and resiliency of New Mexico meadow jumping mouse habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species and critical habitat by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require Forest Service authorization through existing contracting or special use permitting processes. Direct effects on New Mexico meadow jumping mouse may occur as potential locations of forest industry activities could be adjacent to habitat. However, siting criteria outlined in the environmental impact statement and resource protection measures (see Appendix C) for wildlife and aquatic management zones are in place to minimize the potential impacts from the associated forest industry activities.

The potential habitat disturbance by the use of heavy equipment may cause a decrease in species numbers in a particular area and the chipping or mastication within habitat may alter fauna within the area. Ground disturbance associated with these activities would have effects on New Mexico meadow jumping mouse. Adult New Mexico meadow jumping mice occupying an area during the active period are most likely to flee and may change behavior to avoid noise and ground-disturbing activities. Even though riparian areas would be avoided, heavy equipment may cause crushing of nests or abandonment of young. If work takes place outside the active period, these effects would be avoided. However, it is possible that direct effects on the species may still occur because treatment activities during hibernation may disturb hibernating New Mexico meadow jumping mice.

Indirect impacts such as displacement of New Mexico meadow jumping mouse may occur. Any indirect impacts to New Mexico meadow jumping mouse from special use authorizations would be short term, and resource protection measures would minimize impacts to the New Mexico meadow jumping mouse when site-specific treatments occur. No long-term impact to New Mexico meadow jumping mouse is anticipated as these activities would not be long term in nature. Indirect impacts to New Mexico meadow jumping mouse, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Adverse impacts to New Mexico meadow jumping mouse critical habitat may occur as potential locations of forest industry activities could be adjacent to habitat. However, siting criteria outlined in Chapter 2 and resource protection measures for wildlife and aquatic management zones are in place to minimize the potential impacts from the associated forest industry activities. No long-term impacts to New Mexico meadow jumping mouse critical habitat are anticipated as these activities would not be long term in nature and any indirect impacts, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation will be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace New Mexico meadow jumping mouse in the short term. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in habitat. However, New Mexico meadow jumping mouse may be able to move to other parts of riparian habitat to avoid disturbance associated with the management of roads.

The potential habitat disturbance by the use of heavy equipment may cause a decrease in species numbers in a particular area and road management activities within habitat may alter fauna within the area. Ground disturbance associated with these activities would have effects on New Mexico meadow jumping mouse. Adult New Mexico meadow jumping mice occupying an area during the active period are most likely to flee and may change behavior to avoid noise and ground-disturbing activities. Even though riparian areas would be avoided, heavy equipment could cause crushing of nests or abandonment of young. If work takes place outside the active period, these effects would be avoided. However, it is possible that direct effects on the New Mexico meadow jumping mouse may still occur because treatment activities during hibernation may disturb hibernating New Mexico meadow jumping mice. Human disturbance to New Mexico meadow jumping mouse would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

No direct impacts from road management activities associated with the proposed action are expected to impact New Mexico meadow jumping mouse critical habitat. Resource protection measures for wildlife and aquatic management zones are in place to minimize potential impacts from project activities in occupied and critical habitat.

Cumulative Effects for New Mexico Meadow Jumping Mouse

This section addresses cumulative effects of past, present, and reasonably foreseeable non-federal actions that may affect New Mexico meadow jumping mouse individuals and their habitat. See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on threatened and endangered species. The spatial boundary for analyzing the cumulative effects is the Sacramento Ranger District, as it represents a reasonable region in which the wildlife species, when assessed in combination with other cumulative actions, would be impacted if the proposed project were implemented. The effects analysis applies to all ecological response units. The temporal boundary for analyzing the cumulative effects is 30 years, because restoration methods are anticipated to have taken effect in that time period.

In addition to the actions listed in Table 3-1 above, past, present, and reasonably foreseeable non-federal actions within the range of the New Mexico meadow jumping mouse within or near the analysis area boundaries on the Sacramento Ranger District include county and state road maintenance and state, county, or local wildfire-related actions, and timber activities, as well as livestock grazing. Private lands within the known range of the New Mexico meadow jumping mouse near the analysis area have been owned and managed by various landowners since the previous century. These activities are expected to continue and may inhibit nesting or foraging of the New Mexico meadow jumping mouse.

Collectively, these uses on non-federal lands have the potential to have a cumulative effect on the New Mexico meadow jumping mouse and its habitat on a landscape level. Any cumulative impacts to New Mexico meadow jumping mice are not likely to impact the forest-wide population or habitat trends. Impacts would be short term and temporary. Resource protection measures would minimize impacts to the New Mexico meadow jumping mouse when site-specific treatments for the South Sacramento Restoration Project occur (measures Veg-8, Veg-9, Veg-11, Veg-15, Rx-3, Road-5, Road-9, Road-10, Road-11, Water-1 through Water-8, Wildlife-2, Wildlife-3, Wildlife-4, Wildlife-8, Wildlife-12). To the best of our knowledge, actions that are reasonably certain to occur on non-federal land parcels are expected to remain the same. Given the size and scope of the current analysis, it is concluded that these cumulative effects shall not limit the recovery of the New Mexico meadow jumping mouse and its critical habitat on federal lands.

Effects Summary

The proposed action, which includes the forest plan amendment to allow the project to be implemented as designed, may result in indirect effects on the New Mexico meadow jumping mouse. However, resource protection measures would ensure that planning and implementation of any project treatment activities will include pre-treatment evaluations and field surveys as needed for individuals of this species on or near all planned treatment locations prior to any treatment activities. If any individuals of this species are found in or near any planned treatment area, all occupied sites will be protected by at least a 200-foot buffer, in addition to any other protection measures that may be needed to protect all individuals of this species from all types of treatment activities. However, some indirect effects, such as alterations in hydrology, sedimentation, and short-term increased run-off during and immediately after implementation, may result from the proposed actions upslope of the sites. The project will make every attempt to avoid any activities in or around springs, wetlands, or riparian areas, thus avoiding or reducing any impacts to the New Mexico meadow jumping mouse individuals. The hydrologic function of the landscapes should be enhanced by the restoration treatments of the proposed action in the long term. Based on the analysis above, the activities of the proposed action of the project ***may affect but are not likely to adversely affect*** individuals and habitat of the New Mexico meadow jumping mouse. Detailed examination and consideration of impacts to these species are still being conducted in the biological assessment; therefore this effect determination could be revised as this analysis continues.

The proposed action may result in direct effects on New Mexico meadow jumping mouse critical habitat as project activities would occur along the margin of and in some places within the edges of critical habitat. However, resource protection measures would ensure that planning and implementation of any project treatment activities will include pre-treatment evaluations and field surveys as needed for habitat in or near all planned treatment locations prior to any treatment activities. If any suitable habitats are found in or near any planned treatment area, all sites will be protected by at least a 200-foot buffer, in addition to any other protection measures that may be needed to protect all habitat of this species from all types of treatment activities. However, some indirect effects, such as alterations in hydrology and disturbance during implementation, may result from the proposed action. The project will make every attempt to avoid any activities in or near springs, wetlands, or riparian areas, thus avoiding or reducing any impacts to the New Mexico meadow jumping mouse critical habitat. In the long term, the hydrologic function of the landscapes should be enhanced by the restoration treatments of the proposed action. Based on the analysis above, the activities of the proposed action ***may affect, but are not likely to adversely modify*** critical habitat of the New Mexico meadow jumping mouse. Detailed examination and consideration of impacts to these species are still being conducted in the biological assessment; therefore this effect determination could be revised as agency consultation continues.

3.5.4 Forest Plan Amendments

The following amendment components would have the potential to affect threatened and endangered species and their habitats:

- Incorporating new or modified guidance for the management of northern goshawk habitat;
- Incorporating new or modified U.S. Fish and Wildlife Service direction, including the use of a broader range of treatment options over extended time frames in Mexican spotted owl habitat;
- Updating management direction for essential habitat for federally listed species;
- Using ground-based, mechanized equipment on slopes greater than 40 percent; and
- Using herbicides to treat juniper and oak resprouts within municipal watersheds so this restoration tool could be used as appropriate across the entire project area.

The amendment components that would allow ground-based mechanized equipment to be used on slopes greater than 40 percent and allow forest restoration treatments to occur in Mexican spotted owl protected activity centers, northern goshawk habitat, and treatments within other essential habitat for federally listed species would result in short-term negative impacts as well as long-term beneficial impacts to threatened and endangered wildlife species. Allowing treatment to occur on steeper slopes would provide for landscape restoration opportunities that otherwise would not be possible. Impacts would be similar to the direct and indirect vegetation treatment effects described for each species in the wildlife biological evaluation (U.S. Forest Service 2018d). Noise and human presence would likely displace wildlife while treatments are in progress. There is also potential for impacts to breeding success and to foraging opportunities for threatened and endangered species while site-specific treatments are occurring. However, thinning treatments on steep slopes are expected to benefit these species over the long term by improving habitat conditions and reducing the risk of stand-replacing wildfire in areas that would otherwise not be treated.

The proposed changes to herbicide use direction would include authorizing treatment of juniper and oak resprouts within municipal watersheds, near areas of human habitation, or wherever needed to maintain treatments where juniper and oak species exceed desired conditions. In general, small mammals, including the Peñasco least chipmunk and New Mexico meadow jumping mouse, could see the greatest impacts from herbicide use due to their small size and potential to come into direct contact with these chemicals or by consuming treated vegetation. Additionally, the Mexican spotted owl that prey on small mammals could be affected as described in the wildlife biological evaluation (U.S. Forest Service 2018d). The impacts from implementing this amendment component would have the same length and intensity as the direct and indirect effects of herbicide use described in the wildlife biological evaluation (U.S. Forest Service 2018d).

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to threatened and endangered species from the no action alternative and proposed action. Table 3-29 summarizes the effect determinations provided for the proposed action, as required by the Endangered Species Act. Consultation with the U.S. Fish and Wildlife Service is currently underway; therefore, the effect determinations could be revised as agency consultation continues.

Table 3-29. Federally Listed Species with Potential to Occur in the Project Area and the Effect Determinations for Each Species

Species	Federal Status	Known or Potential Occurrence Likely	Effect Determination for Proposed Action
Mexican spotted owl	Threatened	Yes	May Affect, Likely to Adversely Affect
Mexican spotted owl critical habitat	-	Yes	May Affect, Not Likely to Adversely Modify
Peñasco least chipmunk	Candidate	Yes	Not likely to jeopardize individuals and their habitat located within the project area
New Mexico meadow jumping mouse	Endangered	Yes	May Affect, Not Likely to Adversely Affect
New Mexico meadow jumping mouse critical habitat	–	Yes	May Affect, Not Likely to Adversely Modify

Maintaining and improving wildlife habitat, including habitat for threatened and endangered species is one of the primary purposes of the project. Implementation of vegetation treatments would pose adverse impacts in the short term for these species and habitat, however, these impacts would be temporary, and species are expected to return to treated areas after implementation. Overall, resource protection measures would be applied to minimize these potential impacts. The proposed action would improve habitat in the long term for all threatened and endangered species, by creating a more resilient forest habitat, closer to desired conditions for the forest type.

3.6 Other Wildlife Species

3.6.1 Affected Environment

Management Indicator Species

Forest Service Manual 2621 – Management Indicators directs the Forest Service to select management indicator species in the Forest Plan for each forest that best represent the issues, concerns, and opportunities for wildlife on that forest. These selected Management Indicator Species reflect general habitat conditions needed by other species with similar habitats. The evaluation of each Management Indicator Species found within this document was tiered from the 2006 *Lincoln National Forest Management Indicator Species Report and Environmental Impact Statement* for the Lincoln National Forest Land and Resource Management Plan and was reviewed and updated in 2013 by the Lincoln National Forest (U.S. Forest Service 2012b). The Forest Plan identifies 10 management indicator species. Of those, the bird and mammal species identified in Table 3-30 would likely occur or have suitable habitat in the project area and are therefore carried forward in this analysis process. One management indicator species, meadowlark (*Sturnella neglecta*), is dismissed from detailed analysis in this environmental impact statement because key habitat factors for the species arenot found in the project area. Additional information about this species is provided in Appendix C of this environmental impact statement and Appendix A of the wildlife biological evaluation written for the South Sacramento Restoration Project (U.S. Forest Service 2018d).

Table 3-30. Management Indicator Species Analyzed for the South Sacramento Restoration Project

Species	Project Ecological Response Units	Habitat Requirements
Elk (*Cervus canadensis*)	Mixed conifer with aspen, montane/subalpine grassland, mixed conifer-frequent fire forest	Mixed conifer (conifer forest, mountain meadows)
Mule deer (*Odocoileus hemionus*)	Pinyon-juniper woodland, Gambel oak shrubland, and mountain mahogany mixed shrubland	Pinyon-juniper woodland and mixed shrubland (scrubby cover, browse species present, closed landscape)
Red squirrel (*Tamiasciurus hudsonicus*)	Mixed conifer with aspen and mixed conifer-frequent fire forest	Mixed conifer (dense closed-canopy forests with large, cone-bearing trees and scattered openings)
Juniper titmouse (*Baeolophus ridgwayi*)	Pinyon-juniper woodland	Pinyon-juniper woodland (trees with natural cavities)
Pygmy nuthatch (*Sitta pygmaea*)	Ponderosa pine forest, mixed conifer-frequent fire forest	Ponderosa pine (snags and large trees)
Rufous-crowned sparrow (*Aimophila ruficeps*)	Pinyon-juniper grassland, Gambel oak shrubland	Pinyon-juniper grassland
Hairy woodpecker (*Picoides villosus*)	Mixed conifer with aspen	Mature forest and woodland
Mexican vole (*Microtus mexicanus*)	Mesic mountain meadows within mixed conifer with aspen and mixed conifer-frequent fire forest	Mixed conifer (steep mountainous slopes of wet meadows associated with seeps and springs)

Elk (Cervus canadensis)

General Ecology

This species is an indicator species for open, mixed conifer habitat with a mountain meadow component. Most of the project area would be considered generally suitable habitat for elk to utilize year-round with use dependent on the amount and timing of snowfall. Seasonal movement often occurs along the drainages during spring and fall. Elk tend to use the higher elevations to cool off during the hotter spring and summer months. Elk calving takes place in the spring, usually between May or June when adults are en route to higher elevations for the summer. The breeding season occurs in the fall. In general, elk prefer open, grassy meadows located less than 0.5 mile from water. Hiding cover for elk occurs in stands of trees 30 to 60 acres in size with 70 percent canopy cover. Elk also use oak and locust for hiding cover in areas that have had stand-replacing wildfire (U.S. Forest Service 2017d, 2017e).

Historic and Current Habitat/Population Trends

New Mexico's elk populations have fluctuated dramatically over the past 100 years. Populations bottomed out around the turn of the century, and then rebounded as logging, grazing, and burning activities opened up more areas. The New Mexico Department of Game and Fish conducts annual winter aerial surveys for elk in the state Game Management Units. Data from these surveys indicate that elk populations in Unit 34, which overlaps the Sacramento Ranger District, have increased over the last 10 years. According to the elk harvest report (2016) and communications with James Pittman (Elk Biologist, New Mexico Department of Game and Fish), the estimated elk populations for Game Management Unit 34 is 6,010 to 6,262. The population estimate is based off a 4-year average of annual sight-ability surveys. Data from the January 2006 sight-ability survey estimated the elk population to be approximately 1,768 (90 percent confidence interval of 274) for Game Management Unit 34; this estimate was based on a 1-year survey. Current management objectives for elk in this unit are to maintain a stable population.

Cover-to-forage ratios are widely used as an index of elk habitat quality. Prime elk habitat has been estimated to consist of a mix of about 40 percent tree cover and 60 percent forage openings, a 40:60

ratio (Hoover and Wills 1984). The cover-to-forage ratio has been gradually improving on the forest over the past 5 years as a result of wildfires and thinning and burning treatments (Salas 2006). Patches of multistoried, closed-canopy forest provide quality thermal cover for elk during hot summers and cold winters (Hoover and Wills 1984). While elk require cover for protection against heat and extreme cold, ideal forests have meadow habitat interspersed with forest cover, with large amounts of edge (Skovlin 1982). Compared with desired cover-to-forage ratios, the project area currently contains an overabundance of forest cover (hiding and thermal cover) and a shortage of openings filled with grass, forb, and shrub species. Historic meadows and oak groves are nearly all covered with conifer trees. Hiding and thermal cover are abundant due to the very large numbers of small seedlings, saplings, young, and mid-age trees. Stand density is highest in the moist, mixed-conifer forest patches on north- and east-facing slopes and in drainage bottoms, where elk can cool off during the summer.

Mule deer (Odocoileus hemionus)

General Ecology

Although the species is found in many habitat types, mule deer are considered a Management Indicator Species for woodlands in the Forest Plan (U.S. Forest Service 1986a). Therefore, this analysis focuses on impacts to the species within pinyon-juniper woodland. Mule deer habitat is to have sufficient openings in the forest with grasses, forbs, and shrubs to meet their year-round foraging needs. In general, mule deer habitat has been estimated to consist of a 40:60 cover-to-forage ratio with a mix of lower tree canopy cover, abundant and diverse ground vegetation, and stimulation of important forage species following a prescribed burn (Heffelfinger and others 2006).

Historic and Current Habitat and Population Trends

Mule deer are regularly observed throughout southeastern New Mexico and the species is a year-long resident of the project area. They occupy habitats in mountains and lowlands, including woodlands, forest edges, shrublands, and residential areas. Mule deer have been declining in number in New Mexico since populations peaked around the 1960s, similar to declines seen throughout the West (Heffelfinger and Messmer 2003). Records from the New Mexico Department of Game and Fish provide the basis for estimating population trends of this species. The New Mexico Department of Game and Fish uses these data to set harvest regulations and population goals for the species under its jurisdiction. Because of population declines, harvests of mule deer have also declined, i.e., deer harvests were estimated to be as high as 55,000 in 1960, and by 2013, estimates declined to fewer than 10,000. Despite declines, mule deer are present in all 33 counties in New Mexico. Many biologists believe that mule deer populations of the 1960s may have been unnaturally high due to periods of high precipitation, improvements in deer habitat, and declining predator populations resulting from the land management and wildlife management practices of the era. Today’s land and wildlife managers manipulate habitats for a wider variety of uses and wildlife species whose needs are often different than those of deer. Thus, current management practices have returned many deer-friendly shrublands back to their original forest or grassland conditions, and extended periods of drought and competition with other species, like elk, also have been important. Two other possible factors in mule deer population declines are predation by mountain lions, coyotes, and bears, as well as the encroachment of human development into mule deer habitat (New Mexico Department of Game and Fish, unknown date).

Red squirrel (Tamiasciurus hudsonicus)

General Ecology

The red squirrel is endemic to a limited area in New Mexico within the Lincoln National Forest, where it is a Management Indicator Species for mixed-conifer habitats on the Smokey Bear and Sacramento Ranger Districts. It is limited to high-elevation spruce fir forests and principally uses closed canopies in mixed conifer forests with a clumped distribution of large, mature, cone-bearing trees (Reynolds and others 1992). Large trees with interlocking crowns provide the squirrel with a means of escape, access to foraging habitat, and immigration into new areas. Red squirrels prefer to nest in cavities of large snags, but also nest in live trees with thick crowns, and in mistletoe formations (Hedwall and others 2006). They also construct nests out of grasses or other materials and use ground burrows (NatureServe 2017).

The squirrel’s diet includes pinecones, fungi, fruit, seeds, sap, acorns, buds, conifer pollen, birds, and small mammals. The most important food source is cones, and the best cones are from old Douglas-fir trees. The squirrel stores seeds, cones, and acorns in food “caches” to use throughout winter. They place the caches in moist, shady areas, often under dense vegetation, in tree cavities or at the base of large logs to help prevent the cones from opening (Reynolds and others 1992). A home range for the red squirrel is less than 2.5 acres. Approximately 9 to 25 large, mature, cone-producing trees per territory are required to sustain one red squirrel for a single year. The squirrel is often used as prey by the northern goshawk (Reynolds and others 1992). Red squirrel densities on the Sacramento Ranger District are associated with sapling white fir (*Abies concolor*) and mature Douglas-fir trees of at least 40 to 50 inches diameter at breast height (Frey 2007).

Historic and Current Habitat/Population Trends

Red squirrel populations are secure in New Mexico (NatureServe 2017) and monitoring red squirrel populations on the Lincoln National Forest has found their population trend is stable (Salas 2006). Red squirrels are known to occur within the project area and have been studied on the forest as part of previous research projects (Frey and Wampler 2005; Wampler and others 2008). According to Salas (2006), timber harvesting during the latter part of the nineteenth century and early part of the twentieth century likely reduced or eliminated red squirrel habitat on most of the Sacramento Ranger District. In 1986, mixed-conifer habitats were found on approximately 232,591 acres across the forest. In 2005, mixed-conifer currently accounts for 213,702 acres, primarily on the Smokey Bear and Sacramento Ranger Districts. Salas (2006) reported that dense second- and third-growth timber stands currently present on the Lincoln National Forest are likely providing good to excellent habitat for the red squirrel. Forty percent of the acres are within old wildfires, logging units harvested in the late 1970s and early 1980s, and fuel breaks. Also wildland–urban interface protection areas have reduced the suitable habitat by approximately 1,298 acres (Salas 2006). As of 2006, the estimated acreage of habitat with interlocking crowns and trees of cone-bearing age was 128,341 acres (Salas 2006). Red squirrels prefer mature climax forests with large-diameter mixed coniferous and spruce trees. Specifically, on the Sacramento Ranger District, red squirrels prefer sapling white fir and large-diameter, mature Douglas-fir forest habitats, especially relatively cool, mesic areas where these species were regenerating as indicated by the relationship with the density of saplings. Based on the low incident of red squirrel in mature ponderosa pine forests and higher densities in climax-stage mixed conifer forests, it can be concluded that red squirrels avoid open, drier forest sites (Frey 2007).

Juniper titmouse (Baeolophus ridgwayi)

General Ecology

The juniper titmouse is an indicator species for pinyon-juniper woodlands (trees with natural cavities) and is a year-round resident of the Sacramento Ranger District. It is a secondary cavity nester and uses either natural cavities or abandoned holes of primary cavity nesters. Although this species appears to prefer mature and old-growth forests with open canopies for feeding, all structural stages are used. It is often found in woodlands with canopy cover averaging 11 to 25 percent (New Mexico Avian Conservation Partners 2018). Its winter diet is made up of large seeds—pinyon nuts, juniper berries, and oak acorns. It primarily eats insects the rest of the year (Kucera 2005; New Mexico Partners in Flight 2007). Limiting factors for juniper titmouse appear to be lack of available cavities. Older age-class pinyon and juniper trees in open canopy stands are the primary nesting habitat.

Historic and Current Habitat/Population Trends

According to the North American Breeding Bird Survey, juniper titmouse populations appear to have remained stable between 1966 and 2015 (Sauer and others 2017). Partners in Flight estimates a global breeding population of 180,000 with 99 percent living in the United States, and 1 percent in Mexico. The species rates a 12 out of 20 on the Continental Concern Score. Throughout its range, the juniper titmouse is listed as G5 (i.e., globally secure and common, widespread, and abundant) and juniper titmouse is not on the 2014 State of the Birds Watch List (Sauer and others 2017). While populations at the national level show a stable trend, in New Mexico this species is on a downward population trend due to conversion of woodland habitat to rangeland, removal of mature and senescent trees in pinyon-juniper habitat, and overall decline of this habitat due to drought and beetle infestation (Sauer and others 2017). However, monitoring data for the juniper titmouse on the Lincoln National Forest indicate an upward population trend (Salas 2006).

Pygmy nuthatch (Sitta pygmaea)

General Ecology

The pygmy nuthatch is an indicator species for ponderosa pine forest (large trees and snags). This species breeds from May to July and maintains a territory of 1 to 5 acres. They feed 60 to 80 percent on insects, then switch to pine seeds in the winter months. They feed in trees, shrubs, and on the ground (Kingery and Ghalambor 2001). The pygmy nuthatch requires mature and old-growth ponderosa pine and potentially adjacent mixed conifer with relatively open understories (Kingery and Ghalambor 2001), where they depend on cavities in old trees (snags) for roosting and nesting (Ghalambor and Dobbs 2006). They are typically found at lower and middle elevations where ponderosa pine grows, but can sometimes occur up to 10,000 feet, as well as in forests of ponderosa pine mixed with oak, quaking aspen (*Populus tremuloides*), maple (*Acer* spp.), Douglas-fir, or white fir.

Historic and Current Habitat/Population Trends

Throughout the twentieth century, logging, grazing, and fire suppression converted many ponderosa pine forests—previously parklike woodlands with large, tall trees favored by pygmy nuthatches—into mosaics of differently aged trees and dense thickets. Across the forest there has been a decline in the quantity and quality of mature ponderosa pine forest habitat, cumulatively resulting from a combination of wildfires, insect/disease infestations, and long-term fire suppression. The lack of natural fire regimes in the fire-adapted ponderosa pine has resulted in declines in ecosystem composition, structure, and processes. The pygmy nuthatch population has presumably declined as a result, since the pygmy nuthatch relies on mature ponderosa pine and standing dead trees for suitable nest sites and foraging habitat. Removal of snags has been shown to reduce pygmy nuthatch populations (Ghalambor 2003). Throughout its range, the pygmy nuthatch is listed as G5 (i.e., globally secure and common, widespread, and abundant). Populations at the national level show a stable trend. However, surveys by the U.S. Geological Survey since 1968 through 2001 indicate a slightly downward trend within the state of New Mexico (Sauer and others 2017). Based on the best available information, the pygmy nuthatch population trend on the Lincoln National Forest is stable (Salas 2006).

Pygmy nuthatch populations are secure in New Mexico with an upward population trend (NatureServe 2017). Monitoring surveys conducted on the Lincoln National Forest since 2001 to 2004 indicated the pygmy nuthatch population had a downward trend on the Sacramento Ranger District, where the project area is located. Salas reported that population numbers on the Sacramento Ranger District were on upward trend after the Scott Able fire (Salas 2006). Despite fluctuations in populations on specific districts, overall, the population on the forest is estimated to also be stable (Salas 2006).

Rufous-crowned sparrow (Aimophila ruficeps)

General Ecology

Rufous-crowned sparrows are indicator species for mixed shrublands, including those on steep, dry, rocky hillsides with plenty of grasses. This species is not migratory and inhabits the Lincoln National Forest year-round. It feeds primarily on small grass and forb seeds, with insects also making up a portion of the diet. Forage occurs on or near the ground in areas with thick cover. The sparrow nests in sparsely vegetation scrubland, building a nest on the ground or in a low bush. Nesting is estimated to start in April at lower elevations in the project area and continue through May and possibly again during the summer rainy season from July to early September. Dense woody growth is unsuitable habitat. Suppression of natural wildfires has allowed open scrub habitat to grow into dense stands that are unsuitable for this species (Collins 1999; Rising 1996).

Historic and Current Habitat/Population Trends

Throughout its range, the rufous-crowned sparrow is listed as G5 (i.e., globally secure and common, widespread, and abundant). Populations at the national level show a stable trend. Rufous-crowned sparrows are commonly reported by eBird at lower elevation in the Lincoln National Forest (eBird 2016). The habitat and population have been reported stable on the Lincoln National Forest (U.S. Forest Service 2006).

Hairy woodpecker (Picoides villosus)

General Ecology

Hairy woodpecker is an indicator species for aspen (mature and snags) within mixed conifer forests. Hairy woodpeckers are found in woodlots, suburbs, parks, and cemeteries, as well as forest edges, open woodlands of oak and pine, recently burned forests, and stands infested by bark beetles. They can be found equally commonly in coniferous forests, deciduous forests, or mixtures, and generally up to about 6,500 feet elevation (Cornell Lab of Ornithology 2015). The hairy woodpecker is widely distributed wherever there are mature forests with substantial snags. The species is also strongly associated with burned areas, an important historical component of forests resulting from a frequent fire interval. Hairy woodpeckers prefer aspen forest for nesting and foraging. Approximately three snags greater than 13 inches DBH per acre are necessary to support maximum densities of hairy woodpecker (Sousa 1987). Resource protection measures (measures Wildlife-11, Wildlife-14) incorporated for the northern goshawk and Mexican spotted owl will help fulfill snag requirements for the hairy woodpecker. As a primary cavity nester, this woodpecker is dependent on dead and dying portions of live trees and snags for nesting. This species prefers to feed on insects in dead or diseased trees (U.S. Forest Service 2006).

No systematic surveys are conducted specifically for the hairy woodpecker on the Lincoln National Forest; however, it is regularly detected during breeding bird surveys in southeastern New Mexico. Hairy woodpeckers are common and widespread, and their populations increased by just over 1 percent per year between 1966 and 2015, according to the North American Breeding Bird Survey. Partners in Flight estimates a global breeding population of 9 million with 44 percent living in the United States, 52 percent in Canada, and 4 percent in Mexico. They rate a 6 out of 20 on the Continental Concern Score and are not on the 2012 Watch List. Despite their healthy populations there is concern that pressures such as the fragmentation of large forest tracts into smaller parcels and competition for nest holes from the European starling (*Sturnus vulgaris*) could ultimately threaten their numbers (Cornell Lab of Ornithology 2015).

Historic and Current Habitat/Population Trends

Early in the twentieth century, logging and fire that occurred on the Lincoln National Forest increased (to an unknown extent) the presence of aspen. More recently, the aspen component is known to be decreasing because of conifer encroachment due to the absence of large-scale ground fires that are the primary trigger for aspen regeneration. Historic aspen stands are now represented by a few or single stems that are approaching the end of their life span. The deterioration of aspen within the proposed project area indicates a decline in available nesting sites for cavity nesters such as the hairy woodpecker.

The forest trend for aspen and mixed-conifer as habitat for the hairy woodpecker is expected to increase slightly forest-wide as wildfire areas begin to regenerate and aspen maintenance treatments are implemented. However, regeneration of aspen will take time. Regeneration within recent burns has been retarded by over-browsing and disease. Based on observations and the 2006 management indicator species report, the general trend for habitat of aspen and aspen within mixed conifer habitat appears to be downward on the Lincoln National Forest (U.S. Forest Service 2006).

The North American Breeding Bird Survey shows the hairy woodpecker as having a slightly upward trend in population throughout the State of New Mexico from 1966 to 2015. The North American Breeding Bird Survey has estimated a 2.2 percent increase in population trend from 1966 to 2005 (U.S. Forest Service 2006). Based on the above data, it is the professional opinion of the Forest Biologist that the population trend for the hairy woodpecker on the Lincoln National Forest is stable (U.S. Forest Service 2006).

Mexican Vole (Microtus mexicanus)

General Ecology

The Mexican vole (*Microtus mexicanus*) is a management indicator species for mixed conifer habitats containing mesic mountain meadows. The Mexican vole has been specifically identified with high-elevation steep slope meadows containing seeps and springs, defined by high herbaceous cover, primarily grasslands above 8,000 feet elevation (U.S. Forest Service 2002; Ward 2001). Voles primarily occupy these open grassy habitats, often dominated by rushes, sedges and grasses, but have been documented to occupy forested edges adjacent to meadows as numbers increase and individuals disperse to unoccupied areas (Ganey 2014).

Historic and Current Habitat/Population Trends

The Mexican vole has been identified within the proposed project area and on the Sacramento Ranger District during several small mammal surveys. During surveys conducted by Pat Ward, research scientist with the Forest Service Rocky Mountain Research Station from 1992 to 1996, Mexican vole was found to be numerous enough in Mexican spotted owl nest core areas to be one of three primary prey species used by the owl. Colonies were found to range from 70 to 270 individuals per acre, depending on drought conditions for the specific trapping year (Ward 1999), and are closely tied to the mesic mountain meadow habitat type within the mixed conifer ecological response unit. The Lincoln National Forest contains approximately 7,500 acres of mountain meadow habitat, and the Sacramento Ranger District contains 4,537 acres (U.S. Forest Service 2002). This population is considered to be stable across the Lincoln National Forest.

Important Wildlife Game Species

Species historically hunted on the Lincoln National Forest include coyote, squirrel, rabbit, Montezuma quail, black bear, and turkey. The game species that are most commonly hunted in the project area currently include mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), black bear (*Ursus americanus*), and Merriam's wild turkey (*Meleagris gallopavo merriami*). General ecology, and historic and current habitat and population trends for each important wildlife game species, are included in the wildlife biological evaluation (U.S. Forest Service 2018d). Over the past few decades, hunting of game species such as mule deer has declined in the area, and species, like elk, have significantly increased in population.

Regional Forester Sensitive Species

The Forest Service's sensitive species program is designed to help maintain biodiversity and viable populations of species in accordance with National Forest Management Act regulations (36 CFR 219.19). The goal in managing sensitive species habitat is to prevent a trend toward listing under the Endangered Species Act. Sensitive species to be considered in land management planning activities are those designated by the Regional Forester (Forest Service Manual 2670.5). In September 2012, the Regional Forester approved a revised list of sensitive species for the Southwestern Region (U.S. Forest Service 2013c). Biologists reviewed Element of Occurrence Records, GIS locations, and project area ecological response units and habitats to determine presence or absence of sensitive species, and to determine possibly suitable habitat. The Regional Forester Sensitive species for the South Sacramento Restoration Project were identified from these activities and the 2012 Regional Forester Sensitive Species list.

Appendix C contains the full Regional Forester Sensitive Species list for the Lincoln National Forest, includes the complete list of Region 3 sensitive species, includes the sensitive species that occur on or near the Lincoln National Forest, their key habitat requirements, and whether the habitat or species occur on the district, within the proposed project area or both. Table 3-31 identifies the species that are known to occur or have the potential to occur based on the habitat features in the project area, and have been brought forward for further analysis. A brief summary of this information follows the table below.

Table 3-31. Forest Service Sensitive Animal Species with Suitable Habitat in the Project Area

Common Name (Scientific Name)	Group	Habitat	In Project Area?
Sacramento Mountains salamander (*Aneides hardii*)	Amphibians	Known habitat in the Sacramento Mountains are mixed conifer and aspen forests at elevations of 8,000 feet and above, particularly on north-facing slopes.	Yes. Species is endemic and abundant above 8,000 feet in the Sacramento Mountains.
Northern goshawk (*Accipiter gentilis*)	Birds	Ponderosa pine and mixed-conifer forest types, with a variety of age and size classes, are suitable goshawk habitat. The Forest Service Region 3 Policy recommendations call for vegetation structural stage distribution of 10% grass/forb/shrub (vegetation structural stage 1), 10% seedling sapling forest (vegetation structural stage 2), 20% young forest (vegetation structural stage 3), 20% mid-aged forest (vegetation structural stage 4), 20% mature forest (vegetation structural stage 5), and 20% old forest (vegetation structural stage 6).	Yes. Known to occur.
Gray vireo (*Vireo vicinior*)	Birds	A specialist of oneseed juniper (*Juniperus monosperma*) savannahs, from 5,500 to 7,000 feet elevation. Pinyon-juniper habitat that is too sparse or too thick is not used, although foraging quality may improve in thinned stands. Open, mature pinyon-juniper woodland or juniper savannah with a shrubby understory, especially on moderate rocky slopes. Nests are placed in small forks in low trees or shrubs, often less than 10 feet off the ground.	May occur. Project area includes pinyon-juniper vegetation type below 7,000 feet.

Common Name (Scientific Name)	Group	Habitat	In Project Area?
Bald eagle (*Haliaeetus leucocephalus*)	Birds	Occurs in New Mexico year-round. Breeding is restricted to a few areas mainly in the northern part of the state along or near lakes. In migration and during winter months the species is found chiefly along or near rivers and streams and in grasslands associated with large prairie dog (Cynomys sp.) colonies. Found on the Sacramento Ranger District in winter. Typically perches in trees.	May occur. Occasionally foraging on the east side of the district.
Pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*)	Mammals	This bat has been found roosting in caves, rockshelters, and mines at all elevations in New Mexico; however, it is most common in evergreen forests and least common in xeric shrub grasslands. This species is strongly correlated to the availability of caves or cave-like habitat, but it also uses abandoned buildings and rock crevices on cliffs.	May occur due to presence of rocks and cliffs. Has been found in project area near cliffs and foraging near Sunspot in project area.
Spotted bat (*Euderma maculatum*)	Mammals	This species is a cliff dweller that roosts in cracks and crevices in rock in forested areas near open water.	May occur due to the presence of rocks and cliffs. Has been found in the project area in forested mixed conifer area over permanent water, i.e., perennial streams or pot holes or large open drip tank.
Western red bat (*Lasiurus blossevillii*)	Mammals	A migratory species, found throughout western forests where roosting occurs in trees.	May occur due to the presence of trees. Has been found in the project area in forested area over permanent water, i.e., perennial streams or pot holes or large, open drip tank.
New Mexico shrew (*Sorex neomexicanus*)	Mammals	Known from a small range in the Capitan and Sacramento Mountains. Habitat includes meadows and in leaf litter in canyons of coniferous forests, often along streams, as well as mesic conifer-aspen forest in sheltered canyons.	May occur due to presence of coniferous forest, canyons, and meadows in project area. This species is known to occur where Mexican spotted owls are nesting, which are known to occur and nest in the project area.
Ruidoso snaggletooth snail (*Gastrocopta ruidosensis*)	Snails	Found on bare soil, under stones, and in thin accumulations of grass thatch and juniper litter on mid-elevation carbonate cliffs and xeric limestone grasslands along the eastern slopes of the Sangre de Cristo and Sacramento Mountains.	May occur. Found on eastern slopes of Sacramento Mountains and around El Capitan; talus cliffs, slopes, ledges.
Sacramento Mountains checkerspot butterfly (*Euphydryas anicia cloudcrofti*)	Insects	Restricted to montane meadows within the mixed conifer forest at elevations between roughly 7,800 and 9,000 feet in the vicinity of the village of Cloudcroft.	Suitable habitat is present, but it is not known to occur in the project area.

Sacramento Mountains salamander (Aneides hardii)

General Ecology

The Sacramento Mountains salamander occurs in the Sacramento, Capitan, and White Mountains in southern New Mexico. It is currently listed by the State of New Mexico as a threatened species (New Mexico Department of Game and Fish 2016). In the Sacramento Mountains, known habitat includes mixed-conifer and aspen forests at elevations from 7,850 to 11,700 feet, particularly on north-facing slopes. Substantial forest canopy and ground surface cover such as large woody logs, debris, and rocks are key elements of preferred salamander habitat (Degenhardt and others 1996; New Mexico Department of Game and Fish 2016). Logs in an advanced state of decomposition are preferred microhabitat for the salamander. This species can be found under both deciduous and coniferous logs, but they are most often found under coniferous (Douglas-fir) logs (New Mexico Department of Game and Fish 2016; Ramotnik 1997). This species feeds mainly on insects such as ants, spiders, and beetles (Degenhardt and others 1996). This species spends much of the time below the surface, coming out when ground moisture levels are highest and conditions are humid, during rainy conditions in the summer months during the monsoon season between May and September. In drought conditions, the Sacramento Mountains salamander is most likely to be closely associated with cover objects where humidity is higher (Haan and Desmond 2004). It is believed that individuals move to subterranean cavities to avoid freezing temperatures. The Sacramento Mountains salamander must remain moist at all times as it breathes through its skin. The critical thermal maximum for this species is about 91.85 degrees Fahrenheit (Whitford 1968). Soil characteristics following fire and logging can influence the distribution of plethodontid salamanders that occupy the soil-litter interface, though they may persist after habitats have been altered (Ramotnik and Scott 1988).

Logging and other disturbances that cause desiccation of the habitat remain the primary threat to the species. These salamanders have survived historic, low-intensity fires in the Sacramento Mountains but recent fire suppression has created the possibility of stand-replacing fires (New Mexico Department of Game and Fish 2016; Ramotnik and others 2007). This species is also vulnerable to habitat loss by development within their forest habitats, which warrants further research on their distribution and life history (New Mexico Department of Game and Fish 2016; Painter and others 2017). The infectious disease caused by the chytridiomycete fungus (*Batrachochytrium salamandrivorans*) also poses a potential threat to their population (New Mexico Department of Game and Fish 2016; Painter and others 2017; White and others 2016).

Data Sources, Including Surveys Conducted

Surveys for this species were completed throughout the Sacramento Ranger District through a series of several years (1987 to 2017). The protocols are such that when one salamander is found, the stand is considered to be occupied. The only current criteria for designating suitable habitat for the Sacramento Mountains salamander is an elevation of 8,000 feet or above (U.S. Forest Service 2014c). Although survey sites do not represent all mixed conifer within the project area, they do represent those mesic sites which are wet enough to be considered suitable salamander habitat. Of the 450,610 acres on the Sacramento Ranger District, approximately 143,793 acres are suitable habitat for the Sacramento Mountains salamander. All 143,793 acres of suitable habitat have been surveyed at least once from 1987 through 2017. In 2017, 8,040 acres on the Sacramento Ranger District were surveyed with 1,672 acres (21 percent) determined as occupied (U.S. Forest Service 2017f).

Of the 140,000 acres within the South Sacramento Restoration Project, approximately 83,560 acres (60 percent) of the project area have been identified as suitable habitat for the Sacramento Mountains salamander. Of the 83,560 acres of suitable habitat, approximately 39,447 acres (47 percent) of surveyed habitat was found to be occupied within the project area. The surveys were conducted when moisture was sufficient enough to allow salamanders to become active and visible on the surface (U.S. Forest Service 2014c). Areas that have not already been surveyed within the project area but may be suitable habitat would be surveyed prior to site-specific implementation. The New Mexico state salamander working group has recommended that no more than 25 percent of the Sacramento Ranger District’s known occupied habitat have vegetative treatment within a 10-year period. To be within the recommended management standards, only 20,890 acres (or 25 percent of occupied habitat) can have vegetative treatment until more occupied acres are located.

Northern goshawk (Accipiter gentilis)

General Ecology

Northern goshawks occur in ponderosa pine and mixed conifer forest types in a variety of tree age and size classes. The northern goshawk is a generalist species that uses a wide range of mature and immature forest habitat types. The principal forest types occupied by the northern goshawk in the Southwest are ponderosa pine, mixed conifer, and spruce-fir (Reynolds and others 1992). In general, northern goshawks nest in mature to old forest stands of relatively large trees with closed canopies and an open understory. Northern goshawks typically prefer forests with a relatively high canopy closure and greater tree density (Beier and Drennan 1997). The best northern goshawk foraging habitat is believed to consist of forested stands with complex structure having large amounts of downed logs, woody material, and snags. Adequate perches for hunting and flight space for maneuvering are other important characteristics of forested stands used for foraging by northern goshawks. Jays, flickers, and squirrels make up the bulk of their diet.

Breeding habitat includes a nesting area, a post-fledging family area, and a foraging area. The Forest Plan established direction for managing northern goshawk habitat (U.S. Forest Service 1986a:208A-E). The Region 3 Forest Service policy recommendations call for snags, downed logs, woody debris, and openings with reserve trees that are important components of northern goshawk habitat (Cordova and Robbins 2011). At least three snags and five downed logs are needed in spruce-fir and mixed conifer northern goshawk foraging habitat. Canopy cover for a mid-aged mixed conifer forest is one-third 60 percent plus and two-thirds 40 percent plus. The Region 3 Forest Service Policy recommendations also call for an average 10 to 15 tons per acre of woody debris in the mixed conifer type. The Forest Service Region 3 policy recommendations call for vegetation structural stage distribution of 10 percent grass/forb/shrub (vegetation structural stage 1), 10 percent seedling sapling forest (vegetation structural stage 2), 20 percent young forest (vegetation structural stage 3), 20 percent mid-aged forest (vegetation structural stage 4), 20 percent mature forest (vegetation structural stage 5), and 20 percent old forest (vegetation structural stage 6) (see Section 3.2.1 and glossary for full definition of vegetation structural stage).

Snags, downed logs, woody debris, and openings with reserve trees are important components of northern goshawk habitat. Home range establishments are called post-fledgling family areas. Post-fledgling family areas are a minimum of 600 acres in size. Post-fledgling family areas include the nest sites and consist of the habitat most likely to be used by the fledglings during their early development.

Data Sources, Including Surveys Conducted

In 2017, northern goshawk surveys were conducted within the project boundaries as well as outside the known post-fledgling family areas (surveyed for presence/absence only). Post-fledgling family areas have been surveyed in the Sacramento Ranger District since 1987, and at the end of the 2017 season, 49 post-fledgling family areas had been established. Surveys at the post-fledgling family areas confirmed 16.6 percent presence and occupied nests. These data represent the post-fledgling family areas that were monitored in 2017 and not all post-fledgling family areas identified on the Sacramento Ranger District. In total, 19 post-fledgling family areas occur wholly or partially within the South Sacramento Restoration Project area, comprising approximately 11,394 acres (Table 3-32). Aside from the pinyon-juniper woodland ecological response unit, almost the entire project area is considered to be suitable northern goshawk habitat.

Table 3-32. Goshawk Post-Fledgling Family Area Acreage within the South Sacramento Project Area

Goshawk Management Identification Number	Goshawk Post-Fledgling Family Area	Acres within Sacramento Ranger District	Acres within South Sacramento Restoration Project	Percentage in South Sacramento Restoration Project
030802001	Telephone	619.31	619.31	100.00
030802002	Moore	632.79	632.79	100.00
030802003	Turkey	684.00	684.00	100.00

Goshawk Management Identification Number	Goshawk Post-Fledgling Family Area	Acres within Sacramento Ranger District	Acres within South Sacramento Restoration Project	Percentage in South Sacramento Restoration Project
030802006	Agua Chiquita	636.45	421.13	66.17
030802007	Charlotte	657.91	657.91	100.00
030802008	Glenn	665.96	662.56	99.49
030802009	Robin	673.21	673.21	100.00
030802010	Scott Able	607.86	607.87	100.00
030802013	Martin	652.53	652.54	100.00
030802016	Chilcoote	616.82	568.94	92.24
030802017	Lower Hay	671.75	671.76	100.00
030802019	Lightning Lake	672.03	672.03	100.00
030802021	Danley	610.59	610.60	100.00
030802024	Birdie	603.87	603.87	100.00
030802025	Lucas	626.77	626.77	100.00
030802027	Bridge	732.55	732.54	100.00
030802029	Atkinson	601.56	52.71	8.76
030802031	Robertson	644.30	644.30	100.00
030802033	El Paso	599.09	599.09	100.00
Total		**12,209.35**	**11,393.93**	**-**

Where the northern goshawk post-fledgling family areas overlap Mexican spotted owl protected habitat, the spotted owl habitat management requirements take precedence over northern goshawk habitat requirements (U.S. Forest Service 1986a). The post-fledgling family areas are to be managed for as nesting and fledgling habitat. Outside the post-fledgling family areas, the entire project area (except for the pinyon-juniper woodland ecological response unit) is to be managed as northern goshawk foraging habitat, as it is entirely composed of mixed-conifer forest. Forest Plan guidelines require managing northern goshawk habitat within and outside post-fledgling family areas toward a much more balanced vegetation structural stage distribution with a greater representation of mature forest growth stages than is currently found in the project area.

Changes in forest structure and composition have reduced the quality of northern goshawk habitat. This inferior habitat is most likely due to long-term fire suppression, historic logging operations, and resulting lack of surface fire regimes. The lack of large trees over 18 inches in diameter is partly due to some large trees that were removed during historic logging operations during the mining era of the late nineteenth and early twentieth centuries. Another reason is that the lack of surface fire regimes and high stand density results in trees unable to grow to their potential size and are therefore, dying prematurely. However, even with the general under-representation of vegetation structural stage classes 5 and 6, at least some of the approximate 3,000 survey sites meet minimum structural attributes of mature forest as defined in the forest plan. The excess trees are mostly shade-tolerant white fir trees that are less fire-resistant than Douglas-fir and ponderosa pine. Historically, white fir trees did not dominate the dry southwestern mixed-conifer forests like they do today. White fir is not as fire adapted; thick stands of white fir increase the threat of uncharacteristic, high-severity fire. Overgrown forests can reach a zone of imminent mortality: the point where space, nutrients, and sunlight resources are so strained that entire sites lose their vitality and die off. The very high stand densities are exacerbating the deficits of large trees and mature forest habitat needed for nesting/roosting as well as the open understories and grassy openings needed for foraging habitat. Ladder fuels and high stand densities create a higher probability of a large-scale, high-intensity wildfire that could cause a serious loss of northern goshawk habitat.

Gray vireo (Vireo vicinior)

General Ecology

In New Mexico, gray vireos are most often found in open arid pinyon-juniper woodlands or juniper savannah with a shrub component. This also includes foothills and mesas and often in areas with a well-developed grass component. The species has been known to occur in chaparral-juniper, pinyon-juniper, and pinyon-madrone associations as well as mid-elevation montane shrub habitats with rocky slopes and scattered conifers (Barlow 1978; Barlow and others 1999; Hubbard 1970). Gray vireos are often found in areas of moderate shrub cover (35 to 45 percent) with large amounts of bare ground between herbaceous plants (Reeves 1999). In southern New Mexico, gray vireos may associate more with oak, madrone, or desert shrub species. According to Larry Cordova, U.S. Forest Service wildlife biologist, the range of the gray vireo overlaps the Sacramento Mountains even though they have not been confirmed in Lincoln County.

In central New Mexico, the gray vireo typically uses oneseed juniper (*Juniperus monosperma*) savannahs at 5,500 to 7,000 feet, although in west-central New Mexico, the species may occasionally be found in juniper savannahs above 7,200 feet. Gray vireos tend not to use pinyon-juniper habitat if it is either too dense with trees or too open. In many cases where dense pinyon-juniper was treated/thinned, forage quality increased where noxious weeds did not invade (DeLong and Williams 2006; New Mexico Department of Game and Fish 2007). Food consumed during the breeding season is almost exclusively insects during the breeding season, foraging on the ground and in shrubs and trees up to 16 feet. In winter, the species shifts to a predominantly frugivorous diet (Barlow and others 1999). Nesting occurs in forks of trees close to the ground or on the ground (New Mexico Department of Game and Fish 2007). There is a threat of brood parasitism by brown-headed cowbirds (*Molothrus ater*) and habitat alteration.

According to the U.S. Forest Service 2006 management indicator species report, there are approximately 526,703 acres of suitable pinyon-woodland habitat on the Lincoln National Forest. Of the 526,703 acres, approximately 19,220 acres (27 percent) is found within the project area. Much of this habitat is woodlands intermixed with other vegetation types, such as oak.

Data Sources, Including Surveys Conducted

Surveys on the forest/district by Steve West were conducted for gray vireo until 2016. Gray vireo were found in the pinyon-juniper grassland component, on the south end of the Sacramento Ranger District. This includes areas on the south end of the proposed project area.

Bald eagle (Haliaeetus leucocephalus)

General Ecology

The bald eagle is a long-lived raptor closely associated with aquatic habitats. This species migrates and winters in suitable habitat throughout New Mexico (Hubbard 1978). They do not breed on the Lincoln National Forest, but they are increasingly observed during the winter period. They require large lakes or rivers that support fish and waterfowl for their food supply. In New Mexico, nests are placed in large cottonwoods or ponderosa pines, typically in the vicinity of water and often also in close proximity to concentrations of small mammals such as prairie dogs (Williams 2000). For winter foraging habitat, eagles need large trees along the shorelines of fish-bearing lakes or streams to use as overnight roosts or daytime perches from which to look for food. Eagles prefer large snags or leafless deciduous trees to perch in during the day when they are looking for food (Jackman and Jenkins 2004).

Data Sources, Including Surveys Conducted

Bald eagles are common in the Lincoln National Forest in the winter, arriving in early November and leaving in late March. They have been observed at Bonito Lake, a water storage reservoir on private land that belongs to the City of Alamogordo. Bonito Lake is situated directly south and east of the majority of the treatment areas. According to Larry Cordova, U.S. Forest Service wildlife biologist, a pair of eagles and one to two sub-adults winter along the reservoir on a yearly basis; during the day they perch on shoreline snags and large trees to watch for fish and small waterfowl that they prey upon. Bald eagles have also been observed during the winter at nearby Mescalero and Grindstone Reservoirs and other populations have been seen on the north and east sides of the Capitan Mountains. Bald eagle wintering populations have been increasing in the area and the 2007 delisting of the bald eagle from the Endangered Species Act list indicates an upward trend in bald eagle populations across its range.

Pale Townsend's big-eared bat (Corynorhinus townsendii pallescens)

General Ecology

The pale Townsend's big-eared bat are frequently associated with caves and abandoned mines in desert scrub, woodlands, and coniferous forests for day roosts and hibernacula but also use abandoned buildings and crevices on rock cliffs for refuge. The mixed conifer, ponderosa pine forest, and pinyon-juniper woodland habitats that occur in the project area may serve as roosting habitat for the species, as well as any abandoned buildings in the project vicinity. Daytime roosts are principally mine tunnels and caves and occasionally cliffs, cracks, crevices, and trees that must have cave-like spaces, while nighttime roosts are often buildings or bridges. Townsend's big-eared bat forages along edge habitats (e.g., forested edges and intermittent streams), in forested habitat, and along heavily vegetated stream corridors, and in open areas near wooded habitat, though they appear to avoid open, grazed pastureland (Pierson and others 1999). Water sources required for drinking generally must be open and accessible. Pale Townsend's big-eared bats are relatively sedentary; they do not move long distances from hibernacula to summer roosts, nor do they move or forage far from their day roosts. Cattle ponds and meadow grasslands may provide foraging habitat for some individual species. This species specializes in eating moths and other insects such as beetles, flies, and wasps. Pale Townsend's big-eared bat is usually a late flier and will forage along the edge of vegetation. For hibernation, this species prefers roost sites where the temperature is 54 degrees Fahrenheit or less. Pesticide spraying, conversion of native shrub-steppe to grasslands, reduction and conversion of riparian habitats as a result of livestock grazing, and timber harvest have all been implicated in a general downward trend in foraging habitat for pale Townsend's big-eared bat (Pierson and others 1999).

Data Sources, Including Surveys Conducted

Pale Townsend's big-eared bat occurs within the project boundary within hibernaculas (winter) and a maternal (summer) colony in a small cave system. This cave also provides maternity roosting habitat for fringed myotis (*Myotis thysanodes*). This species has been detected during acoustic and mist-netting surveys. Surveys were conducted in 2011, 2012, and 2014, and although no other bat species were identified during the time of the surveys, it is suspected that other bat species may use this cave during fall and spring migratory seasons, or as temporary roosting during the summer. Pale Townsend's big-eared bats also occur within a mine shaft to the west of the project area along the western escarpment, within 3 miles of Sunspot (Stewart 2017).

Spotted bat (Euderma maculatum)

General Ecology

The spotted bat is a New Mexico state threatened species. Spotted bats are migrants of the Lincoln National Forest (U.S. Forest Service 1995a). Spotted bats are thought to be residents of the ponderosa pine tree type in June and July and wander to lower elevations in late summer and autumn. Cattle ponds and meadow grasslands may provide foraging habitat for some individual species (Findley and others 1975). The spotted bat is found in ponderosa pine montane forests, pinyon-juniper woodlands, and open semi-desert shrublands. Rocky cliffs are necessary to provide suitable cracks and crevices for roosting, as is access to water. Spotted bats forage on small moths as their primary food source but will sometimes prey on June beetles and grasshoppers. The bat shows apparent seasonal change in habitat, occupying ponderosa pine woodlands in the reproductive season and lower elevations at other times of the year (Biota Information System of New Mexico 2018). The main threats to the species are habitat alteration, over collection, toxic chemicals, and roost loss and modification.

Data Sources, Including Surveys Conducted

This bat has been found in New Mexico from the vicinity of the Rio Grande valley westward, occurring most regularly in the Jemez, San Mateo, and Mogollon Mountains and on Mt. Taylor, which are key habitat areas (Biota Information System of New Mexico 2018). However, spotted bats have been captured in mist nets at Bailey Canyon (north of the project area) and via acoustical call recording along the Rio Peñasco, about 4 miles east of the project area.

Western red bat (Lasiurus blossevillii)

General Ecology

Western red bat is a Region 3 sensitive species found in forests throughout the region. This tree-roosting species occurs along intermittent and perennial streams and roosts in large shrubs and trees. Western red bats are also known to occur at the edges of forests, fields, and urban areas. Streamside habitats dominated by deciduous trees, such as by cottonwoods, Gambel oak, and other riparian species are preferred. This species is migratory and only present during the summer when they emerge from their roosts several hours after dusk to forage on a variety of flying insects. The forests that occur in the project area may serve as roosting and foraging habitat for the species, especially the riparian forests along canyons.

Data Sources, Including Surveys Conducted

Surveys for the western red bat have been conducted from 2011 to 2015, and captures have been recorded above permanent water sources from Bailey Canyon north of the project area.

New Mexico shrew (Sorex neomexicanus)

General Ecology

The New Mexico shrew occurs in south-central New Mexico in the Capitan and Sacramento Mountains using mixed-conifer habitats year-round, such as areas containing spruce fir, Douglas-fir and white fir, and ponderosa pine (Frey 2004). The range of the New Mexico shrew possibly extends as far east as the Pecos River (Alexander 1996). This species prefers higher-elevation mesic habitats where there is moist vegetation, such as along drainages, canyons bottoms, or headwaters that have been drained. It is typically found in locations where owls are nesting (Alexander 1996). Findley and others (1975) noted that this species is found in ponderosa pine forests where ground cover and moist humus provide cover near water at high elevations. New Mexico shrews are relatively common in their preferred habitat (Gannon 2000).

Data Sources, Including Surveys Conducted

Findley and others (1975) included this species within the vagrant shrew (*Sorex vagrans*) species. However, the subspecies was elevated to a distinct species by Alexander (1996) based on morphometric analysis of skulls. Specimens of the New Mexico shrew were collected from the top of the mountain range northeast of Cloudcroft, New Mexico. All of these individuals were collected in traps placed under logs in a mixture of forest types on slopes above 9,000 feet elevation (Bailey 1932). The Rocky Mountain Research Station and New Mexico State University have conducted surveys in the early 2000s and found this species on the Sacramento Ranger District (Frey 2005; Wampler and others 2008).

Ruidoso snaggletooth snail (Gastrocopta ruidosensis)

General Ecology

The Ruidoso snaggletooth snail, a member of the subgenus *Albinula*, is found on bare soil, under stones, and in thin accumulations of grass thatch and juniper litter on mid-elevation carbonate cliffs and xeric limestone grasslands along the eastern slopes of the Sangre de Cristo and Sacramento Mountains in eastern New Mexico (Metcalf and Smartt 1997; Nekola and Coles 2010). The primary habitat for this species is found within ponderosa pine forests and scrub mahogany/Gambel oak vegetation types. Many accounts of the species have been taken in the transitional zones along canyons in forested areas.

Data Sources, Including Surveys Conducted

Based on discussions with the Lincoln National Forest biologist, the species has been found on the eastern slopes of Sacramento Mountains on talus cliffs, slopes, and ledges (Biota Information System of New Mexico 2018). While survey information is limited from the Lincoln National Forest, many have been found in Tularosa and Peñasco Canyons, where collection efforts have been concentrated (Metcalf and Smartt 1997).

Sacramento Mountains checkerspot butterfly (Euphydryas anicia cloudcrofti)

General Ecology

The Sacramento Mountains checkerspot butterfly inhabits meadows within mixed-conifer forests at elevations between 7,800 to 9,000 feet in the vicinity of the Village of Cloudcroft, Otero County, New Mexico. The adult butterfly is often found in association with the larval food plants, New Mexico penstemon (*Penstemon neomexicanus*), valerian (*Valeriana edulis*), and adult nectar sources such as orange sneezeweed (*Helenium hoopesii*). Specialist insects, such as the Sacramento Mountains checkerspot butterfly, typically are highly selective of oviposition (egg-laying) sites and larval food sources, and are not known to survive far from their host plants (Janz 2003). New Mexico penstemon, the primary host plant, is a narrowly endemic perennial forb that grows in south-central New Mexico, within Lincoln and Otero Counties, in the Capitan and Sacramento Mountains (New Mexico Rare Plant Technical Council 1999; Sivinski and Knight 1996). Throughout its limited and isolated high-elevation range, the species is common and relatively abundant (Pittenger and Yori 2003). Valerian may be a secondary larval host plant, particularly in early spring if environmental conditions have not been favorable for growth of New Mexico penstemon (Weiss and others 1988). Consistent with the role of a secondary host plant, valerian has been used as a food resource in the spring by post-diapause larvae, but eggs have not been found in association with valerian. Usually eggs are found only with the primary host plant (U.S. Fish and Wildlife Service and others 2004).

The preferred adult food is nectar from orange sneezeweed (*H. hoopesii*), a native perennial forb that flowers from mid-June through August, with the appearance of the Sacramento Mountains checkerspot butterfly. Although the flowers of *H. hoopesii* are most frequently used by adults for nectar, the Sacramento Mountains checkerspot butterfly has been observed sipping nectar at other plants, including New Mexico elder (*Sambucus cerulea*), yellow salsify (*Tragopogon dubius*), western yarrow (*Achillea millefolium*), spike verbena (*Verbena macdougalii*), dandelion (*Taraxacum officinale*), figwort (*Scrophularia montana*), short-rayed coneflower (*Ratibida tagetes*), cutleaf coneflower (*Rudbeckia laciniata*), musk thistle (*Carduus nutans*), Arizona rose (*Rosa woodsii*), Wheeler's wallflower (*Erysimum* *capitatum*), and wild onion (*Allium* spp.) (Pittenger and Yori 2003; U.S. Fish and Wildlife Service and others 2004).

Data Sources, Including Surveys Conducted

The extent of the historical range of the butterfly is not known due to limited information collected on this subspecies prior to its description (Ferris and Holland 1980). Earliest documented collections of the butterfly were made in 1963 at Pines Campground, the type locality for the Sacramento Mountains checkerspot butterfly, 1.6 kilometers (1 mile) northeast of Cloudcroft at 2,622 meters (8,600 feet) in elevation (Toliver and others 1994). Due to their conspicuous nature, butterflies in the genus *Euphydryas* are widely collected and well studied and are known to be restricted to specific habitats (Cullenward and others 1979; Ehrlich and others 1975; Murphy and Weiss 1988). Over the past 40 years, lepidopterists have surveyed and collected throughout the Sacramento Mountains within suitable habitat and have not located the species outside the currently occupied locations (Cary and Holland 1992; Ferris and Holland 1980; Hager and Stafford 1999; Toliver and others 1994; U.S. Forest Service 2003b).

As of October 2004, the known range of the butterfly is within a 6-mile radius around the Village of Cloudcroft, spanning an area of 85 square kilometers (33 square miles). The butterfly occurs on lands administered by the Sacramento Ranger District of the Lincoln National Forest as well as private lands. Within this area, the butterfly's distribution is patchy and disjunct. The known range of the butterfly is delimited on the north by Mescalero Apache Nation lands, on the west by Bailey Canyon at the mouth of Mexican Canyon, on the east by Spud Patch Canyon, and on the south by Cox Canyon (U.S. Forest Service 2000a, 2000b). Surveys in the past have not found the species in the project area.

In 1999, the Forest Service devised a model using survey results and geographic information system technology (U.S. Forest Service 1999a). The model incorporated non-forested openings visible on 1:24,000-scale ortho-photo quadrangles, preferred elevational ranges (8,000 to 9,000 feet), and known occupied locales. Based on the model, the Forest Service estimated there were approximately 5,198 acres of suitable habitat. Suitable butterfly habitat was roughly evenly divided between private lands (2,553 acres) and National Forest System lands (2,645 acres) (U.S. Forest Service 1999a, 1999b, 1999c, 2000a, 2000b). Ground-truthing surveys between 1997 and 2003 documented that the distribution of the butterfly within the known range is discontinuous and generally located in non-forested openings along drainages, roadways, campgrounds, and valleys (U.S. Forest Service 1999b, 1999c, 2000a, 2000b, 2003b).

The Forest Service revised its estimates of the butterfly's suitable habitat in 2004 using global positioning system survey data in conjunction with the original geographic information system model. The estimates included only lands within the proposed critical habitat boundary for the butterfly because no Sacramento Mountains checkerspot butterflies have been recorded outside this area since the scientific discovery of the subspecies. Currently, the total suitable habitat available to the butterfly consists of 2,709 acres located on National Forest System and private lands, with 1,196 acres occupied by the butterfly on National Forest System lands and 777 acres occupied on private lands (U.S. Forest Service 2004). Approximately 736 acres of the 2,709 acres of suitable habitat are unoccupied, with 736 acres on National Forest System lands and 542 acres on private lands (U.S. Forest Service 2004). The total suitable habitat is divided into the following proportions: 44 percent consists of occupied National Forest System lands, 29 percent consists of occupied private lands, 7 percent remains unoccupied on National Forest System lands, and 20 percent remains unoccupied on private lands.

Neo-tropical Migratory Birds and Bald and Golden Eagles

The Migratory Bird Treaty Act prohibits the taking, killing, or possessing of migratory birds unless permitted by regulations promulgated by the Secretary of the Interior. On January 10, 2001, Executive Order 13186 was signed placing emphasis on conservation of migratory birds. The Executive Order supplements the Migratory Bird Treaty Act, which has been in effect since the early 1900s.

Golden and bald eagles are protected under the Bald and Golden Eagle Protection Act. Under this Act, take is defined as to ". . . pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest or disturb." Disturb is further defined as ". . . to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." Bald and golden eagles are also protected under the Migratory Bird Treaty Act, which also prohibits take.

Habitat conditions within the project area for the potentially affected migratory bird species have been altered and degraded over time by a combination of human activities in the area. Historic stand-replacing fires prior to 1945 removed many trees, logging in the early 1900s removed the larger conifer trees in accessible areas, and historic livestock grazing reduced the abundance of tall grasses in some areas. Those activities, combined with fire suppression since the early 1900s, resulted in a lack of frequent surface fires that once maintained fire-adapted ecosystems used by many migratory birds.

Partners in Flight Priority Species

The Partners in Flight Priority Watch List of 83 species of highest conservation concern includes bird species that are most at risk of extinction without conservation actions to reverse declines and reduce threats.

Important Bird Areas

With its varied habitat and elevations, the Lincoln National Forest provides a unique opportunity for bird watchers. The Audubon Society recognizes areas with unique habitat or importance as "Important Bird Areas." These sites provide essential riparian corridors for one or more species of birds for breeding, wintering, or migrating. There is one identified important bird area in the project area, Peñasco Canyon. The Peñasco Canyon important bird area is a 4,137-acre high mountain canyon area that includes some private inholdings along with lands managed by the Lincoln National Forest. This canyon contains Mexican spotted owls and other high-priority species in great abundance. There are many protected activity centers identified for nesting and roosting Mexican spotted owls throughout this important bird area.

Overwintering Areas

Due to the high elevation and the potential for high snow accumulation, the project area would not be considered an area where concentrations of birds overwinter.

General ecology, and historic and current habitat and population trends for each of the above species are included in the wildlife biological evaluation (U.S. Forest Service 2018d).

Incomplete or Unavailable Information

Survey data specific to the Lincoln National Forest were not available for some of the species analyzed in the wildlife biological evaluation (U.S. Forest Service 2018d). For these species, data and information about the species, population status, key habitat features, and threats were gleaned from data and research specific to the species in other parts of New Mexico or the Southwest, typically using the information sources listed above. In particular, information was lacking for the following species analyzed in this evaluation: gray vireo (*Vireo vicinior*), spotted bat (*Euderma maculatum*), western red bat (*Lasiurus blossevillii*), New Mexico shrew (*Sorex neomexicanus*), Ruidoso snaggletooth snail (*Gastrocopta ruidosensis*), robust cottontail (*Sylvilagus robustus*), zephyr eyed silkmoth (*Automeris zephyria*), and the Sacramento Mountains checkerspot butterfly (*Euphydryas anicia cloudcrofti*). The Sacramento Mountains checkerspot butterfly has not been observed within the project area and it is assumed the project area has no suitable habitat present for this species. Therefore, survey data are lacking due to the assumed lack of habitat.

3.6.2 Methodology and Assumptions Used for Analysis

Resource Indicators and Measures

Regional Forester's Sensitive Species: The analysis for these species looks at impacts to individuals, local populations and species habitat. Species are assumed to be potentially present if suitable habitat is present. Resource measures include: Disturbance to, loss of, or displacement of individuals; and changes to habitat suitability or availability, including habitat size and quality. Potential Determination of Impacts include: No Impact; Beneficial Impact; May Impact Individuals, but Not Likely to Cause a Trend to Federal Listing or Loss of Viability; Likely to Result in a Trend toward Federal Listing or a Loss of Viability for/to the species or its habitat.

Management Indicator Species: The analysis for these species looks at impacts to associated habitats and impacts to populations trends of the species. Resource measures include: Changes in associated habitats suitability or availability; and changes to population trends. The determination of impacts could include: Population Trend (stable, upward or downward trends): No impact; Slight impacts, no change to population trend; Large impacts, changes to population trend.

Neo-Tropical Migratory Birds: The analysis for these species looks at impacts to individuals, habitat, and population trends. Resource measures include: Disturbance to, loss of, or displacement of individuals; disruption of key life behaviors (e.g. breeding, nesting, fledging, roosting, foraging, etc.); changes to habitat suitability or availability; and changes to statewide population trends. Impacts to neo-tropical migratory bird population trends can include: No Impact; Slight Impacts; Large Impacts.

Important Game Species: Analysis of game species includes impacts to individuals, and impacts to population trends, as well as the disruptions of behavior and changes to habitat. Resource measures include: Disturbance to, loss of, or displacement of individuals; and changes to statewide population trends. Impact determinations may include: Population Trend (stable, upward or downward trends): No impact; Slight impacts, no change to population trend; Large impacts, changes to population trend.

For the analysis of direct and indirect effects, short-term impacts are impacts lasting up to 2 years from when the action was implemented, and long-term impacts are impacts lasting longer than 2 years. The spatial boundary used for analysis in this report varies, depending on the species or category of species and is defined within the discussion of impacts within each species evaluation addressed below.

3.6.3 Environmental Consequences

Management Indicator Species

Elk (Cervus canadensis)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on the currently stable elk population trends on the district and forest because proposed project activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any temporary increase in open road density. Forest and woodland vegetation trends in the project area would continue to degrade elk habitat quality in these fire-adapted ecosystems. Cover-to-forage ratio would remain suboptimal. Forage availability would continue to be quite limited, due to the high stand densities that dominate the project area and lack of canopy openings. Forest-wide population and habitat trends would not measurably change as a result of this alternative. The no action alternative also creates the possibility of a large-scale, high-intensity wildfire burning though the project area.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on elk in the form of habitat disturbance during project implementation. Approximately 35,600 acres of representative elk habitat would be treated by vegetation thinning and 68,200 acres would be treated using prescribed fire—that is, approximately 17 percent and 32 percent of representative elk habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). The proposed action treatments and associated resource protection measures will enhance elk foraging and cover habitat and elk population trends will remain stable, if not trend upward as a result of the improved habitat conditions. Short-term, temporary impacts from the proposed action on elk populations and elk foraging and cover habitat on the Lincoln National Forest will be localized, not landscape-wide, and over a short duration of time. Some individuals of this species may be impacted, but the majority of the population will be maintained and will recover quickly.

The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, the treatments in every vegetative type would benefit this species by increasing quality and quantity of browse species that elk uses, as well as improve forest resiliency so that elk habitat continues to persist on the landscape. The elk population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

Suitable open, mixed conifer habitat for this species would be maintained or increased by mechanical thinning and any tree thinning, particularly group selection matrix thinning, would create better foraging and cover habitat for elk. Vegetation treatments are not expected to negatively impact elk hiding cover habitat because stands are currently overstocked and resource protection measures (measures Wildlife-2, Wildlife-5, Wildlife-8, Water-2) would retain a certain amount of canopy cover and slash on the ground in mixed conifer stands. Any direct impacts to hiding cover from treatments would be short term, and elk could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the vegetation treatments would improve the health and resiliency of mixed conifer stands, thereby maintaining or increasing suitable foraging and cover habitat, and overall distribution of elk. Indirect impacts to elk from human disturbance resulting from crews and equipment during project implementation would be localized and for short-term durations.

Effects from the Use of Fire

Under the proposed action, suitable habitat of elk (open, mixed conifer habitat with a mountain meadow component) would be treated with prescribed burning, which would increase the availability of habitats favored by elk. Another beneficial impact to elk habitat from prescribed burns would be creating suitable hiding cover and foraging habitat where elk can utilize the oak and locust for browsing. Any direct impacts to elk from treatments would be short term, and elk could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. To mitigate impacts, resource protection measures (measures Rx-4, Wildlife-2, Wildlife-5, Wildlife-8, Wildlife-14) would retain adequate canopy cover and slash on the ground in mixed conifer stands for the species. In the long term, the prescribed burns would improve the health and resiliency of open, mixed conifer habitat, thereby maintaining or increasing suitable foraging and cover habitat, and overall distribution of elk in the Lincoln National Forest. Indirect impacts to elk, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide would be used to control juniper and oak sprouts, where feasible. Impacts to elk from herbicide treatments would be minimal and short term, in that the amount of juniper and oak sprouts treated would not create a shortage of sprouts available for elk browsing. However, resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance within elk habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact elk. Indirect impacts to elk from foraging in treated areas are not expected to have a measurable effect to elk because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Indirect impacts to elk, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of elk habitat to the adverse effects of drought. Other activities such as water developments (dual use) and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on elk are expected, as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of elk may occur. Any indirect impacts to elk from special use authorizations would be short term, and elk could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to elk is anticipated as these activities would not be long term in nature. Human disturbance to elk would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated, including seeding roads, after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Rehabilitation of roads may also include seeding roads, which can also benefit grazers such as elk. Road management activities associated with the proposed action may temporarily displace elk in the short term. However, elk would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Human disturbance to elk would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Given that elk are highly mobile and that there is an abundance of mature, mixed-conifer habitat throughout the district and forest, the proposed road management actions would not likely result in a downward trend in the forest-wide population. However, resource protection measures (measures SOP- 7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Rehabilitating roads includes seeding, which can also benefit grazers such as elk. Based on the overall benefits of the proposed action, i.e., reduction in the potential for high-severity fires, improving forest health, and diversifying habitat conditions across the project area, habitat for elk is assumed to be improved and/or restored. It is possible that the creation of diverse habitat features could result in elk becoming reestablished or increasing in the project area.

Mule deer (Odocoileus hemionus)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on the currently declining mule deer population trends on the district and forest because proposed project activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any temporary increase in open road density. Forest and woodland vegetation trends in the project area would continue to degrade mule deer habitat quality in these fire-adapted ecosystems. Cover-to-forage ratio would remain suboptimal. Forage availability would continue to be quite limited, due to the high stand densities that dominate the project area and lack of canopy openings. Forest-wide population and habitat trends would not measurably change as a result of this alternative. No action alternative also creates the possibility of a large-scale, high-intensity wildfire burning though the project area.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on mule deer in the form of habitat disturbance during project implementation. Approximately 10,000 acres of representative mule deer habitat would be treated by vegetation thinning and 26,600 acres would be treated using prescribed fire (approximately 3 percent and 7 percent of representative mule deer habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively). However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). Short-term impacts from the proposed action will be localized, not landscape-wide, and over a short duration of time. Some individuals of this species may be impacted, but the majority of the population will be maintained and will recover quickly.

In the long term the proposed treatments will improve and increase mule deer cover and forage habitat and should increase mule deer populations as a result of the improved habitat conditions. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, the treatments in every vegetative type would benefit this species by increasing quality and quantity of browse species that the mule deer uses, as well as improve forest resiliency so that mule deer habitat continues to persist on the landscape. The mule deer population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

Suitable woodland habitat for this species would be maintained or increased by mechanical thinning and any tree thinning, particularly group selection matrix thinning, would create better foraging and cover habitat for mule deer. Implementation of the project would not alter the number of acres currently typed as pinyon-juniper but would change density of trees in the existing pinyon-juniper woodland habitat, as well as create openings to increase herbaceous cover and the desired “edge” that this species prefers. Vegetation treatments are not expected to negatively impact mule deer cover habitat because woodland stands are currently overstocked and the resource protection measures (measures Wildlife-2 through Wildlife-5, Wildlife-8, Water-2) would retain a certain amount of canopy cover and slash on the ground in mixed conifer stands. Any direct impacts to hiding cover from treatments would be short term, and mule deer could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the vegetation treatments would improve the health and resiliency of woodlands, thereby maintaining or increasing suitable foraging and cover habitat, as well as overall distribution of mule deer. Indirect impacts to mule deer, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from the Use of Fire

Under the proposed action, pinyon-juniper woodlands and shrublands would be treated with prescribed burning, which would increase the availability of early successional stages, favored by mule deer. Another beneficial impact to mule deer habitat from prescribed burns would be creating more suitable habitat with lower tree canopy cover, ground vegetation, and plant foraging species. Any direct impacts to mule deer from treatments would be short term, and mule deer could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. To mitigate impacts, resource protection measures (measures Rx-4, Wildlife-2 through Wildlife-5, Wildlife-8, Wildlife-14) would retain a certain amount of canopy cover and slash on the ground in woodland habitats. In the long term, the prescribed burns would improve the health and resiliency of woodlands, thereby maintaining or increasing suitable foraging and cover habitat, as well as overall distribution of mule deer in the Lincoln National Forest. Indirect impacts to mule deer, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide would be used to control juniper and oak sprouts, where feasible. Impacts to mule deer from herbicide treatments would be minimal and short term, in that the amount of juniper and oak sprouts treated would not create a shortage of sprouts available for mule deer browsing. However, resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance within mule deer habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact mule deer. Indirect impacts to mule deer from foraging in treated areas are not expected to have a measurable effect to mule deer because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Indirect impacts to mule deer, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of mule deer habitat to the adverse effects of drought. Other activities such as water developments (dual use) and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on mule deer are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of mule deer may occur. Any indirect impacts to mule deer from special use authorizations would be short term, and mule deer could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to mule deer is anticipated as these activities would not be long term in nature. Indirect impacts to mule deer, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace mule deer in the short term. However, mule deer would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to mule deer would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Red squirrel (Tamiasciurus hudsonicus)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on red squirrel habitat or population trends because proposed project activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. Red squirrel caches, cavity trees, and mistletoe-induced witches' brooms (a deformity in the branches of the tree, when small twigs start growing in the same location) would continue to occur. However, the vegetation trends previously described would continue to cause a decline in the quality of mature, mixed conifer forest habitat for this species.

Density-related tree mortality in the larger trees (600 to 900 trees per acre) would be expected to continue. Remaining trees would remain growth suppressed, causing a further decline in the largest, most mature trees and a shift toward more seedlings and saplings. As the larger trees continue to die and fall over prematurely, there would be a loss of large overstory canopy cover and a decline in the average tree sizes and ages. The imbalance of age diversity and a stand density index approaching or beyond the zone of imminent mortality threaten the vitality of the vegetative zone and its ecological dependents such as the red squirrel. Thus, the imbalance in proportions of small young trees of vegetation structural stage classes 2 to 3 to large mature trees of vegetation structural stage classes of 5 to 6 would continue to be significant. There would be plenty of snags and downed logs, which are key habitat requirements for the red squirrel.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on red squirrel in the form of habitat disturbance during project implementation. Approximately 34,600 acres of representative red squirrel habitat would be treated by vegetation thinning and 67,000 acres would be treated using prescribed fire (approximately 17 percent and 34 percent of representative red squirrel habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively). However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). Some individuals of this species may be impacted, but the majority of the population will be maintained and will recover quickly. In the long term, treatments would promote growth of smaller, residual trees to become large, mature trees and treatments would also retain high canopy cover within the clumps of larger, more mature trees based on forest plan requirements for the Mexican spotted owl and northern goshawk. Large patches and clumps of mature trees next to small openings in the canopy would help maintain a mix of suitable nesting and foraging habitat for the red squirrel. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, this would benefit this species by increasing quality and quantity of habitat that the red squirrel uses, as well as improve forest resiliency so that red squirrel habitat continues to persist on the landscape. The red squirrel population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

Suitable mixed-conifer habitat for this species would be maintained or increased by mechanical thinning and any tree thinning, particularly group selection matrix thinning, would create better closed, interlocking canopy habitat with a clumped distribution of large, mature, cone-bearing trees. Implementation of the project would not alter the number of acres currently typed as mixed-conifer, but would change density of trees in existing habitat, as well as create closed-canopy habitat that this species prefers for foraging and utilizes for predator escape. Vegetation thinning would reduce the numbers of smaller trees that currently dominate the mixed conifer forest stands and would move stands toward tree numbers found to be preferable to the red squirrel. Vegetation treatments are not expected to directly impact red squirrel habitat because resource protection measures (measures Wildlife-3, Wildlife-4, Wildlife-6 through Wildlife-8, Wildlife-10, Water-2) would provide for ample numbers of large, mature trees. The reduction in understory tree density may increase the risk of predation on red squirrels by northern goshawks or other predators. However, the high number of residual trees, including some dense patches and clumps of smaller trees and large overstory trees with dense crowns, would continue to provide adequate hiding cover for the squirrel. Any direct impacts from treatments may affect individual red squirrels but is not likely to impact the forest-wide population or habitat trends. Impacts would be short term, and red squirrels could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the vegetation treatments would improve the health and resiliency of mixed-conifer habitats, thereby maintaining or increasing suitable habitat for red squirrels. Indirect impacts to red squirrel, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from the Use of Fire

Direct impacts from prescribed fire treatments could burn up some of the food caches (cone storage sites on the ground) of the red squirrel. However, resource protection measures (measures Rx-4, Wildlife-3, Wildlife-4, Wildlife-6 through Wildlife-8, Wildlife-10, Wildlife-14) during implementation would minimize potential losses of cone caches. In the long term, burning treatments would increase habitat for red squirrel through retention of large, mature, cone-bearing trees. Providing adequate habitat would in turn support the red squirrel population trends. Any direct impacts from treatments may affect individual red squirrels but are not likely to impact the forest-wide population or habitat trends. Impacts would be short term, and red squirrels could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the burning treatments would improve the health and resiliency of mixed-conifer habitats, thereby maintaining or increasing suitable habitat for red squirrels. Indirect impacts to red squirrel, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact available food sources; however, red squirrels prefer cones and other food from mixed-conifer sources and treatments likely would not impact red squirrel individuals. However, resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within red squirrel habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact red squirrel. Indirect impacts to red squirrel from food source concerns in treated areas are not expected to have a measurable effect on the red squirrel because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to red squirrel, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of red squirrel habitat to the adverse effects of drought. Other activities such as water developments (dual use) and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on red squirrel are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of red squirrel may occur. Any indirect impacts to red squirrel from special use authorizations would be short term, and red squirrels could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to red squirrel is anticipated as these activities would not be long term in nature. Indirect impacts to red squirrel, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace red squirrel in the short term. However, red squirrel would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to red squirrel would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Juniper titmouse (Baeolophus ridgwayi)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on juniper titmouse habitat or population trends because the proposed project activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. However, the vegetation trends associated with the lack of large, low-intensity surface fires would continue to degrade habitat quality within the fire-adapted woodland habitat. In particular, there would be continued declines in large trees due to growth suppression and insect-caused mortality. The lack of large-diameter, mature junipers with snags and open cavities within a mostly open-canopy habitat would continue to decrease over time without management or disturbance. These trends may affect individual birds, although the juniper titmouse habitat and forest-wide population trends would likely continue to remain relatively stable.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on juniper titmouse in the form of habitat disturbance during project implementation. Approximately 10,000 acres of representative juniper titmouse habitat would be treated by vegetation thinning and 14,000 acres would be treated using prescribed fire (approximately 3 percent and 4 percent of representative juniper titmouse habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively). However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). Impacts from the proposed action for juniper titmouse on the Lincoln National Forest will be localized, not landscape-wide, and over a period of time and populations are expected to remain stable, if not trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

In the long term, treatments would promote growth of smaller, residual trees to become large, mature trees with canopy cover suitable for the species. Treatments would also retain and create natural cavities and help maintain a mix of suitable nesting and foraging habitat for the juniper titmouse.
The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, this would benefit this species by increasing quality and quantity of habitat that the juniper titmouse uses, as well as improving forest resiliency so that juniper titmouse habitat continues to persist on the landscape. The juniper titmouse population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

The proposed action would improve nesting and foraging habitat for the juniper titmouse by reducing tree densities, creating opening canopies, and promoting development of larger trees, snags, and other old-growth components in pinyon-juniper vegetation habitats. Treatments are designed to maintain or enhance mature and old-growth characteristics, with variable densities and size classes, which would maintain or enhance habitat requirements for the juniper titmouse. Direct impacts from the proposed action may displace individuals during treatment operations if cavity-bearing nest trees were cut down during the breeding season. Resource protection measures (measures Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10, Water-2) required in the proposed action would limit this potential effect by emphasizing the retention of the largest tree(s) possible and considering modifications to treatments to protect and retain the largest trees in stands during treatments. Ground-disturbing activities occurring during the breeding season may reduce some nesting success during and after the initial implementation within the project area. If any treatments occur during the breeding season (April through June), nesting behavior may be altered. The mechanical thinning will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire.

Vegetation thinning would focus on removing the least-healthy trees and favor shade-intolerant, early-succession species in a stand, such as Douglas-fir, ponderosa pine, and pinyon, regardless of size, that have been reduced due to competition and struggle for water, nutrients, and sunlight. Free thinning would also be used as a sanitation treatment in stands that have a high level of dwarf mistletoe infection, where at least half of the host trees are infected and group selection treatments are determined to be ineffective at controlling the level of infection because of the general widespread nature of the infection. Approximately 8,400 acres would be restored using this thinning treatment. Free thinning treatment is only proposed on 100 acres of pinyon-juniper grassland habitat out of 110 acres within the project area; this treatment is not proposed at all in the 10,000 acres of pinyon-juniper woodland in the project area.

Any direct impacts from treatments may affect individual juniper titmouse but are not likely to impact the forest-wide population or habitat trends. Impacts would be short term, and individuals could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. Indirect effects of the proposed action would create a more natural diversity of ages among stands. This will create an opportunity for more trees to move into the mature class that are required nesting habitat for the juniper titmouse. This will also reduce the possibility of a stand-replacing wildfire that would create large patches of mortality and reduce the age class diversity of future regenerating stands of trees. In the long term, thinning treatments would increase habitat for juniper titmouse through development of larger trees, snags, open canopies, and other old-growth components in pinyon-juniper vegetation habitats. Providing adequate habitat would in turn support the juniper titmouse population trends. Resource protection measures are also built into the project and address the need to retain large trees and snags to provide wildlife habitat (measures Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10). In pinyon-juniper habitat, resource protection measures will retain a minimum of one large tree (at least 12 inches diameter at root collar) per 3 acres. In areas with alligator juniper, resource protection measures will retain two alligator junipers per acre. The resource protection measures (measures Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10) will emphasize the retention of the largest tree(s) possible. Thinning treatments and resource protection measures will help retain mature and senescent trees within pinyon-juniper habitat while improving overall habitat conditions and resilience to drought, insects, and disease. Considering that the juniper titmouse population on the Lincoln National Forest is trending upward and that the proposed action would improve habitat conditions, the proposed action is expected to contribute to the overall forest-level population trend.

Effects from the Use of Fire

Direct impacts from prescribed fire treatments could burn up cavity-bearing nest trees if treatments occur during the breeding season. However, resource protection measures (measures Rx-4, Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10) during implementation would identify cavity-bearing nest trees to mitigate loss and protect and retain the largest trees in stands during treatments. In the long term, burning treatments would increase habitat for juniper titmouse through development of larger trees, snags, open canopies, and other old-growth components in pinyon-juniper vegetation habitats. Prescribed burning will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire and prescribed fire will directly create and increase snag habitat that this species uses for nesting. Providing adequate habitat would in turn support the juniper titmouse population trends. Fire also often creates fire scars and cavities in trees to replace the ones burned down. Considering that the juniper titmouse population on the Lincoln National Forest is trending upward and that the proposed action would improve habitat conditions, the proposed action is expected to contribute to the overall forest-level population trend.

Any direct impacts from treatments may affect individual juniper titmouse but are not likely to impact the forest-wide population or habitat trends. Impacts would be short term, and juniper titmouse could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the burning treatments would improve the health and resiliency of pinyon-juniper woodland habitats, thereby maintaining or increasing suitable habitat for juniper titmouse. Indirect impacts to juniper titmouse, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact juniper titmouse in the form of ground-disturbing activities occurring during project implementation. If treatments within the project area occur during and after the breeding season, nesting behavior and success may be reduced during the initial implementation. However, resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within juniper titmouse habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact juniper titmouse. Indirect impacts to juniper titmouse from food source concerns in treated areas are not expected to have a measurable effect on the juniper titmouse because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to juniper titmouse, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of juniper titmouse habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on juniper titmouse are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of juniper titmouse may occur. Any indirect impacts to juniper titmouse from special use authorizations would be short term, and juniper titmouse could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to juniper titmouse is anticipated as these activities would not be long term in nature. Indirect impacts to juniper titmouse, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace juniper titmouse in the short term. However, juniper titmouse would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to juniper titmouse would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Pygmy nuthatch (Sitta pygmaea)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on the pygmy nuthatch habitat or population trends because the proposed project activities would not be implemented in this project area. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. However, the vegetation trends associated with the lack of large, low- intensity surface fires would continue to degrade habitat quality within the fire-adapted ponderosa pine habitat. Foliage loss on dying large ponderosa pine could decrease foraging habitat for the pygmy nuthatch. The number of mature trees and snags providing nesting habitat would remain relatively stable as the trees remain suppressed in growth and development. The amount of foraging habitat would continue to decrease over time as the amount of plant life in the area declines due to tree competition and shading. In particular, there would be continued declines in large trees due to growth suppression and insect-caused death as they approach imminent mortality. These trends may affect individual birds, although the habitat and population trends would likely continue to remain relatively stable. A no action alternative also creates the possibility of a large, high-intensity wildfire.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on pygmy nuthatch in the form of habitat disturbance during project implementation. Approximately 29,700 acres of representative pygmy nuthatch habitat would be treated by vegetation thinning and 63,200 acres would be treated using prescribed fire (approximately 10 percent and 22 percent of representative pygmy nuthatch habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively). However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). Impacts from the proposed action for pygmy nuthatch on the Lincoln National Forest will be localized, not landscape-wide, and over a period of time and populations are expected to remain stable, if not trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

In the long term, treatments would retain mature and old-growth ponderosa pine and promote growth of smaller, residual trees to become large, mature trees suitable for the species. Treatments would also retain natural cavities and help maintain a mix of suitable nesting and foraging habitat for the pygmy nuthatch. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, this would benefit this species by increasing the quality and quantity of habitat that the pygmy nuthatch uses, as well as improve forest resiliency so that pygmy nuthatch habitat continues to persist on the landscape. The pygmy nuthatch population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

Within the project area, there are 17,450 acres of ponderosa pine forest and under this alternative, approximately 7,800 acres of ponderosa pine forests would be thinned and approximately 12,500 acres would be treated through prescribed burning. Suitable habitat for this species would be maintained and increased by mechanical thinning, which would create open-canopy forests. Mature and old-growth forests that provide suitable habitat for the pygmy nuthatch would be maintained by removing overcrowding within the existing stands. Resource protection measures (measures Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8, Water-2) would retain large trees, as well as snags used by the pygmy nuthatch for nesting. Additionally, the proposed vegetation treatments have been designed to retain trees and stands with old-growth characteristics and the treatments would promote future development of old-growth stands. Direct impacts from the proposed action may displace individuals during treatment operations if cavity-bearing nest trees were cut down during the breeding season. Resource protection measures (Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8) would limit this potential effect by emphasizing the retention of the largest tree(s) possible and considering modifications to treatments to protect and retain the largest trees in stands during treatments. The required number of snags that this species needs will be retained by implementing northern goshawk and Mexican spotted owl resource protection measures (Wildlife-11, Wildlife-14). This project does not target the removal of snags but proposes the recruitment and retention of snags. The proposed action will improve this habitat by moving the ponderosa pine stands toward a more mature seral stage. The retention of snags and large trees would allow adequate nesting and foraging habitat during and after project implementation.

Ground-disturbing activities occurring during the breeding season may reduce some nesting success during and after the initial implementation within the project area. If any treatments occur during the breeding season (April through June), nesting behavior may be altered. The mechanical thinning will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire. Therefore, the population trend is expected to be stable. Given that important habitat features would be protected and that overall habitat conditions would improve in the long term, it is expected that the population trend for the pygmy nuthatch on the Lincoln National forest would remain stable under the proposed action.

Effects from the Use of Fire

Within the project area, there are 17,450 acres of ponderosa pine forest and under this alternative, approximately 12,500 acres of ponderosa pine forests would be treated through prescribed burning. Suitable habitat for this species would be maintained and increased by prescribed burning and wildland fire use, which would create open-canopy forests. Mature and old-growth forests that provide desirable habitat for the pygmy nuthatch would be maintained by removing overcrowding within the existing stands. Prescribed burns and managed wildfires will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire. The prescribed fire will directly create and increase snag habitat that this species utilizes for nesting. The required number of snags that this species needs will be retained by implementing northern goshawk and Mexican spotted owl resource protection measures (measures Rx-4, Wildlife-2 through Wildlife-10, Wildlife-11, Wildlife-14). This project does not target the removal of snags but proposes the recruitment and retention of snags. It will also improve the habitat for this species by uneven-aged management through fire and moving the ponderosa pine stands toward a more mature seral stage. The retention of snags and large trees would allow adequate nesting and foraging habitat during and after project implementation.

Direct impacts from prescribed burns and managed wildfires may temporarily displace individuals during treatment operations if cavity-bearing nest trees were burned down during the breeding season. Resource protection measures (measures Wildlife-11, Wildlife-14) would limit this potential effect by emphasizing the retention of the largest tree(s) possible and considering modifications to treatments to protect and retain the largest trees in stands during treatments. Ground-disturbing activities occurring during the breeding season may reduce some nesting success during and after the initial implementation within the project area. If any treatments occur during the breeding season (April through June), nesting behavior may be altered. Prescribed burns will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire. Therefore, the population trend is expected to be stable. Given that important habitat features would be protected and that overall habitat conditions would improve in the long term, it is expected that the population trend for the pygmy nuthatch on the Lincoln National forest would remain stable under the proposed action.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact pygmy nuthatch in the form of ground-disturbing activities occurring during project implementation. If treatments within the project area occur during and after the breeding season, nesting behavior and success may be reduced during the initial implementation. However, resource protection measures (Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within pygmy nuthatch habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact pygmy nuthatch. Indirect impacts to pygmy nuthatch from food source concerns in treated areas are not expected to have a measurable effect on the pygmy nuthatch because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to pygmy nuthatch, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of pygmy nuthatch habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on pygmy nuthatch are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of pygmy nuthatch may occur. Any indirect impacts to pygmy nuthatch from special use authorizations would be short term, and pygmy nuthatch could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to pygmy nuthatch is anticipated as these activities would not be long term in nature. Indirect impacts to pygmy nuthatch, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace pygmy nuthatch in the short term. However, pygmy nuthatch would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to pygmy nuthatch would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Rufous-crowned sparrow (Aimophila ruficeps)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on the rufous-crowned sparrow habitat or population trends because the proposed project activities would not be implemented in this project area. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. However, the vegetation trends associated with the lack of large, low- intensity surface fires would continue to degrade habitat quality within mixed shrubland habitat. Foliage loss on dying shrubs could decrease foraging habitat for the rufous-crowned sparrow. The number of shrubs providing nesting habitat would remain relatively stable as the trees remain suppressed in growth and development. The amount of foraging habitat would continue to decrease over time as the amount of plant life in the area declines due to tree competition and shading. In particular, there would be continued declines in large trees due to growth suppression and insect-caused death as they approach imminent mortality. These trends may affect individual birds, although the habitat and population trends would likely continue to remain relatively stable. A no action alternative also creates the possibility of a large, high-intensity wildfire.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on rufous-crowned sparrow in the form of habitat disturbance during project implementation. Approximately 110 acres of representative rufous-crowned sparrow habitat would be treated by vegetation thinning and 2,520 acres would be treated using prescribed fire (that is, approximately 0.1 percent and 1 percent of representative rufous-crowned sparrow habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively). However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). Impacts from the proposed action for rufous-crowned sparrow are considered to be temporary, short term, and populations are expected to remain stable, if not trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

In the long term, treatments would maintain or enhance mixed shrublands characteristics preferred by the rufous-crowned sparrow. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, this would benefit this species by increasing quality and quantity of habitat that the rufous-crowned sparrow uses, as well as improve forest resiliency so that rufous-crowned sparrow habitat continues to persist on the landscape. The rufous-crowned sparrow population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

The proposed action would improve nesting and foraging habitat for the rufous-crowned sparrow by creating openings and sparsely vegetated areas desired by this species in mixed shrubland vegetation habitats. Treatments are designed to maintain or enhance mixed shrublands characteristics, with variable densities and size classes, which would enhance habitat requirements for the rufous-crowned sparrow by promoting grass and seed food source components. Direct impacts from the proposed action may displace individuals during treatment operations for a short period, since the species is not migratory. Additional direct impacts to nesting behavior and nesting success could occur if treatment operations occur during the breeding season or if nesting shrubs are thinned. However, resource protection measures (measures Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10, Water-2) required in the proposed action would limit this potential effect by emphasizing the retention of mixed shrubland habitats with plenty of grasses and retain low bush habitat for nesting. Indirect impacts in the form of ground-disturbing activities may also reduce nesting success if proposed action treatments occur during the breeding season. Mechanical thinning will directly reduce the amount of fuels and reduce the risk of stand-replacing wildfire, but this treatment may impact nesting success as rufous-crowned sparrows build nests on the ground or in low bush habitats. These impacts would be short term in duration and should not have long-term impacts and the species should recover quickly. Effects on habitat would be minimal from mechanical or hand treatments on slopes and hillsides where fewer trees may exist to be cut. However, in the long term, these vegetation treatments would improve habitat conditions for the rufous-crowned sparrow by creating openings and sparsely vegetated areas desired by this species by promoting grass and seed food sources.

In the long term, thinning vegetation treatments under the proposed action would improve habitat conditions for the rufous-crowned sparrow and population trends would remain stable because habitat conditions would be improved. Based on the overall benefits of the proposed action, i.e., reducing the potential for uncharacteristic, high-severity fires, improving forest health, and diversifying habitat conditions across the project area, habitat for the rufous-crowned sparrow is assumed to be improved and/or restored. It is possible that the creation of diverse habitat features could result in the rufous-crowned sparrow becoming reestablished or more prolific in the project area.

Effects from the Use of Fire

Direct impacts from prescribed fire treatments could burn up mixed shrubland habitats for foraging, breeding, and nesting if treatments occur during the breeding season. Direct impacts from the proposed action may displace individuals during treatment operations for a short period, since the species is not migratory. Additional direct impacts to nesting behavior and nesting success could occur if treatment operations occur during the breeding season or if nesting shrubs are burned. However, resource protection measures (measures Rx-4, Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10) required in the proposed action would limit this potential effect by emphasizing the retention and enhancement of mixed shrubland habitats with plenty of grasses and retain low bush habitat for nesting. Maintaining these mixed shrublands characteristics, with variable densities and size classes, would enhance habitat requirements for the rufous-crowned sparrow by promoting grass and seed food source components. Burning in mixed shrublands with grasses during the nesting season could result in direct impacts to nests, adult birds, and young birds in the area. However, in the long term, these vegetation treatments would improve habitat conditions for the rufous-crowned sparrow by creating openings and sparsely vegetated areas desired by this species by promoting grass and seed food sources.

Any direct impacts from prescribed burn treatments may affect individual rufous-crowned sparrows but are not likely to impact the forest-wide population or habitat trends. Impacts would be short term, and rufous-crowned sparrow could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the prescribed burn treatments would improve the health and resiliency of mixed shrubland habitats, thereby maintaining or increasing suitable habitat for rufous-crowned sparrow. Indirect impacts to rufous-crowned sparrow, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Generally speaking, vegetation treatments in mixed shrublands in and around the Lincoln National Forest would disturb the rufous-crowned sparrow. Treatments during the nesting season would displace the rufous-crowned sparrow and could result in impacts to occupied nests. Resource protection measures (Public-3, Herbicide-1 through Herbicide-6) should be followed to avoid impacts to the rufous-crowned sparrow for any treatments, specifically new herbicide treatments for new biological control agents. These new agents would require completion of a risk assessment as well as Forest Service approvals. It is unknown how many acres or when treatments on adjacent lands would be implemented.

Direct impacts from herbicide treatments could impact rufous-crowned sparrow in the form of ground-disturbing activities occurring during project implementation. If treatments within the project area occur during and after the breeding season, nesting behavior and success may be reduced during the initial implementation. However, resource protection measures (Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within rufous-crowned sparrow habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact rufous-crowned sparrows. Indirect impacts to rufous-crowned sparrows from consuming insects and seeds in treated areas are not expected to have a measurable effect on the rufous-crowned sparrow because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat and nesting conditions. Indirect impacts to rufous-crowned sparrow, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of rufous-crowned sparrow habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on rufous-crowned sparrow are expected as resource protection measures (SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of rufous-crowned sparrow may occur. Any indirect impacts to rufous-crowned sparrow from special use authorizations would be short term, and rufous-crowned sparrow could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to rufous-crowned sparrow is anticipated as these activities would not be long term in nature. Indirect impacts to rufous-crowned sparrow, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace rufous-crowned sparrow in the short term. However, rufous-crowned sparrow would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to rufous-crowned sparrow would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Hairy woodpecker (Picoides villosus)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on the hairy woodpecker habitat or population trends because the proposed project activities would not be implemented in this project area. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. The no action alternative would not disturb any nest sites or remove habitat in the short term. The no action alternative does continue a management practice that produces vegetation trends associated with the lack of large, low-intensity surface fires. The lack of natural ground fire would continue to degrade habitat quality within the fire-adapted woodland habitat. There would be continued declines in large trees due to growth suppression and insect-caused mortality. Aspen, already declining because of conifer invasion, will continue to degrade. This trend toward the loss of hairy woodpecker habitat will create relocation into higher elevations or to other aspen stands found in the adjacent wilderness. The possibility of high-intensity wildfire could also affect individual hairy woodpecker, although the effects upon birds of large-scale fires depends on the severity and scale.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on hairy woodpecker in the form of habitat disturbance during project implementation. Approximately 13,100 acres of representative hairy woodpecker habitat would be treated by vegetation thinning and 17,000 acres would be treated using prescribed fire (that is, approximately 37 percent and 48 percent of representative hairy woodpecker habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively). However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

In the long term, treatments would retain mature mixed conifer habitat with an aspen component or aspen stands and promote growth of smaller, residual trees to become large, mature trees suitable for the species. Treatments would also retain natural cavities and help maintain a mix of suitable nesting and foraging habitat for the hairy woodpecker. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, this would benefit this species by increasing quality and quantity of habitat that the hairy woodpecker uses, as well as improve forest resiliency so that hairy woodpecker habitat continues to persist on the landscape. The hairy woodpecker population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

Mechanical thinning may remove some nest sites and the direct effects associated with this treatment on habitat will be short term due to the resource protection measures (measures Wildlife-3, Wildlife-7, Wildlife-8, Wildlife-10) associated with the proposed action (e.g., retaining snags). Direct impacts from the proposed action may displace individuals during treatment operations if cavity-bearing nest trees were cut down during the breeding season. Resource protection measures (Wildlife-3, Wildlife-7, Wildlife-8, Water-2) would limit this potential effect by emphasizing the retention of the largest tree(s) and snags possible to meet the habitat suitability index of three snags greater than 13 inches in DBH per acre. In addition, the required number of snags that this species needs will be retained by implementing northern goshawk and Mexican spotted owl resource protection measures (measures Wildlife-11, Wildlife-14). This project does not target the removal of snags but proposes the recruitment and retention of snags. The proposed action will improve this habitat by moving the ponderosa pine stands toward a more mature seral stage. The retention of snags and large trees would allow adequate nesting and foraging habitat during and after project implementation.

Ground-disturbing activities occurring during the breeding season may reduce some nesting success during and after the initial implementation within the project area. If any treatments occur during the breeding season, nesting behavior may be altered. The mechanical thinning will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire. Ground disturbance associated with mechanical treatment may stimulate aspen suckering, therefore creating conditions for aspen regeneration. More aggressive thinning in historic aspen stands may stimulate aspen suckering. Resource protection measures (measures Wildlife-7, Wildlife-8, Wildlife-10) such as retaining snags will retain future foraging and nesting sites for this species. Therefore, the population trend is expected to be stable. Given that important habitat features would be protected and that overall habitat conditions would improve in the long term, it is expected that the population trend for the hairy woodpecker on the Lincoln National forest would remain stable under the proposed action.

Effects from the Use of Fire

Suitable habitat for this species would be maintained and increased by prescribed burning and wildland fire use, which would create random disturbance over the landscape and increase snags. Mature and old-growth mixed conifer forests with stands of aspen that provide desirable habitat for the hairy woodpecker would be maintained. Prescribed burns and managed wildfires will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire. The prescribed fire will directly create and increase snag habitat that this species utilizes for nesting and foraging. The required number of snags that this species needs will be retained by implementing northern goshawk and Mexican spotted owl resource protection measures (measures Wildlife-11, Wildlife-14). This project does not target the removal of snags but proposes the recruitment and retention of snags. It will also improve the habitat for this species by uneven-aged management through fire.

Direct impacts from prescribed burns and managed wildfires may remove some nest sites. However, the direct effects associated with this treatment on habitat will be short term due to the resource protection measures (measures Rx-4, Wildlife-7, Wildlife-8, Wildlife-10) associated with the proposed action (e.g., retaining snags, burning parameters). Prescribed burning may temporarily displace individuals during treatment operations if cavity-bearing nest trees were burned down during the breeding season. Resource protection measures (Rx-4, Wildlife-7, Wildlife-8, Wildlife-10) would limit this potential effect by emphasizing the retention of the largest tree(s) and snags possible to meet the habitat suitability index of three snags greater than 13 inches in DBH per acre. This project does not target the removal of snags but proposes the recruitment and retention of snags. The retention of large trees and snags would allow adequate nesting and foraging habitat during and after project implementation. Fire also often creates fire scars and cavities in trees to replace the ones burned down.

Indirect effects, such as ground-disturbing activities, occurring during the breeding season (April through June) may reduce some nesting success during and after the initial implementation within the project area by altering nesting behavior or its habitat. Foraging and nesting activities will increase within the project area after the initial implementation of disturbance. Prescribed burning will create additional understory within its habitat by some overstory removal. This will increase fruits and insects that this species forages on. The prescribed burning will help create the conditions where aspen will increase within the project area. The burning associated with the proposed action will serve as a recruitment tool for snags within the project area and offset any loss of snags during implementation. Snag recruitment will also create opportunities for this species to forage on boring insects. Light burning some of the existing hard snags will create soft snags. Soft snags are easier for hairy woodpecker to create cavities for nesting. It is expected that increased foraging and nesting activities will occur after prescribed burning. Given that important habitat features would be protected and that overall habitat conditions would improve in the long term, it is expected that the population trend for the hairy woodpecker on the Lincoln National forest would remain stable under the proposed action.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact hairy woodpecker in the form of ground-disturbing activities occurring during project implementation. If treatments within the project area occur during and after the breeding season, nesting behavior and success may be reduced during the initial implementation. Foraging and nesting activities will increase within the project area after the initial implementation of disturbance. Resource protection measures (Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within hairy woodpecker habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact hairy woodpecker. Indirect impacts to hairy woodpecker from consuming insects and seeds in treated areas may affect a few individuals but are not expected to have a measurable effect on the hairy woodpecker population. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat and nesting conditions. Indirect impacts to hairy woodpecker, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of hairy woodpecker habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on hairy woodpecker are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of hairy woodpecker may occur. Any indirect impacts to hairy woodpecker from special use authorizations would be short term, and hairy woodpecker could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to hairy woodpecker is anticipated as these activities would not be long term in nature. Indirect impacts to hairy woodpecker, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace hairy woodpecker in the short term. However, hairy woodpecker would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to hairy woodpecker would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Mexican Vole (Microtus mexicanus)

Alternative 1 – No Action

Under this alternative, there would be no project-related impacts to the Mexican vole or its habitat in the area because the project would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. Under the no action alternative, Mexican vole habitat would continue to be at a high risk of uncharacteristic fire events. This would have negative and positive effects on Mexican vole habitat. The loss of large tree canopy cover adjacent to the key habitat of high-elevation mesic meadow would potentially increase the available habitat for the vole. But often high-intensity burned areas lose the organic layer with valuable nutrients, and become highly hydrophobic, resulting in loss of topsoil in subsequent sediment and ash flows. The no action alternative does not propose necessary treatments needed for sustaining or enhancing Mexican vole habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on the Mexican vole in the form of habitat disturbance during project implementation. Approximately 34,600 acres of representative Mexican vole habitat would be treated by vegetation thinning and 67,000 acres would be treated using prescribed fire, which is approximately 17 percent and 34 percent of representative Mexican vole habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, some treatment activities may occur when the ground surface and soils are wet. During these periods, potential adverse effects would be mitigated through the application of the resource protection measures described in the text below as Mexican vole may be under ground cover. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve, and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to the Mexican vole during meadow restoration and indirect impacts through sedimentation, considering the species prefers open mesic meadow habitats where there is moist vegetation. Thinning treatments would remove the smallest trees in the understory and fewer of the live overstory canopy. The result would be a reduction in tree density, which would enhance the hydrological recharge areas above the seeps and springs. Direct impacts of these treatments would remove woody encroachment along the edges of the Mexican vole habitat, increasing the open grassy characteristics. Resource protection measures (measures Water-1, Water-2, Water-4, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8) and timing restrictions are in place to protect the Sacramento Mountains salamander on these sites by restricting or prohibiting heavy machinery in these areas to prevent compaction and loss of hydrological function. Since these areas are normally moist year-round, the protections for seeps, springs, and moist meadows are specifically designed to prevent entry into these sites. The potential disturbance of ground cover and moist humus for Mexican vole by the use of heavy equipment at the edges of the grassy mesic meadows during removal of woody encroachment may cause a decrease in species numbers in that particular area. Although treatments would not occur within the seeps and springs, activities along the edges have the potential to increase sedimentation into the mesic areas, which may alter prey species and suitable cover for the vole. The chipping or mastication should not occur within occupied habitat, but would occur along thinning and edges of the meadows, and may alter fauna within the area, which would impact the insect prey species of the Mexican vole.

Treatment activities will benefit the Mexican vole by increasing and expanding mesic meadow openings, especially along the habitat interface. Within a year following thinning treatments, there would be a substantial increase in the abundance of grasses and forbs, especially in the small canopy gaps. Increases in grasses and forbs in the understory would increase substrate for insect prey species of the Mexican vole.

Effects from the Use of Fire

The restoration methods and associated activities of the project could have a direct impact to Mexican vole and indirect impacts through temporary loss of habitat, considering the species prefers mesic meadow habitats with a rush, grass, and sedge vegetative component. All prescribed burn treatment areas within Mexican vole habitat are intended to be low-intensity, fast-moving ground surface burns. Direct impacts of prescribed burning would temporarily reduce the soil moisture available for the Mexican vole and its prey species for the first few months. The mosaic pattern of the burn would also open some of the canopy within occupied habitat and remove or knock back encroaching woody vegetation. The prescribed fire should lead to greater fauna diversity that its prey utilize as well. This would in return improve the foraging habitat of the Mexican vole. Grasses and forbs would rapidly grow in and help conserve the soil moisture.

Indirect effects may occur in the form of sedimentation from the occasional use of heavy equipment upslope from the seeps and spring, causing a silted-in disturbance to moist ground cover areas for Mexican vole. This could cause a decrease in species numbers in a particular area, but not in every site. Resource protection measures (measures Rx-4, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8) and timing restrictions are in place to protect Sacramento Mountains salamander on these sites. Based on the overall benefits of the proposed action, i.e., reducing the potential for uncharacteristic high-severity fires and improving forest health, as well as fire’s role in meadow restoration, habitat for the Mexican vole is assumed to be improved and/or restored.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. There are no juniper or oak occurrences above 8,000 feet in or near open mesic meadow or seep and spring habitat that would be treated. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within Mexican vole habitat. Herbicide treatments would not occur in or near wet or mesic areas, therefore these applications are not expected to directly impact the Mexican vole. Only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Indirect impacts to the Mexican vole are not expected, as human disturbance resulting from crews and equipment during project implementation are not expected to occur in or near these areas.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15 through Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Mexican vole habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require Forest Service authorization through existing contracting or special use permitting processes. No direct effects on the Mexican vole are expected as resource protection measures in place for wildlife could minimize impacts from forest industry activities (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11). As no special use activities can be placed in or near the mesic meadow and seep and spring habitat, indirect impacts such as displacement of individuals are not expected occur. No long-term impact to Mexican vole is anticipated, as these activities would not be placed in or near Mexican vole habitat.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace Mexican vole in the short term, as some of these roads do occur adjacent to or across seep and spring habitat. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. However, Mexican vole may be able to move to other parts of the mesic meadow habitat to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to Mexican vole would be localized and short term, resulting from crews and equipment during project implementation. Indirect effects would include increased sedimentation and run-off into downslope habitat, affecting the ground and litter cover, and temporarily reducing insect prey species for the Mexican vole. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site specific treatments are completed.

Important Wildlife Game Species

Black bear (Ursus americanus)

Alternative 1 – No Action

Under this alternative, there would be no project-related impacts to black bear or their habitat in the area because the project would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would continue to be adequate foraging habitat conditions in the area to continue to support black bears. The numbers of snags and downed logs would continue to increase as the overgrown stands continue to decline across age classes and from the anticipated high levels of mistletoe and bark beetle infestations, which would improve the availability of insects and fungi for black bear foraging. However, the quantity and quality of shrubs, nuts, acorns, fruits, berries, and tall young grasses and forbs would all continue to decline due to the high densities of trees that would dominate this landscape. As high densities of larger trees die out, high densities of seedlings and saplings would fill in, especially due to the continued lack of prescribed surface fires. Overall, habitat conditions for the black bear in the project area would not improve as the trend towards smaller vegetation structural stage classes would continue. Open spaces that grew understory that provided mast would still be absent. This alternative would not provide long-term, sustainable habitat and food for black bear.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on black bear in the form of habitat disturbance during project implementation. Approximately 53,910 acres of representative black bear habitat would be treated by vegetation thinning and 108,120 acres would be treated using prescribed fire, which is approximately 6 percent and 12 percent of representative black bear habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly. In the long term, treatments would retain and enhance the optimum cover and forage ratio for black bears suitable for the species. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, this would benefit this species by increasing the quality and quantity of habitat that the black bear uses, as well as improve forest resiliency so that black bear habitat continues to persist on the landscape. The black bear population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

Under the proposed action, direct impacts to black bear would likely be in the form of large reductions in hiding cover, thereby increasing vulnerability to being killed by hunters. However, there would remain scattered thickets of trees and oak shrubs available for hiding cover. This cover could improve rapidly as the open space provides sunlight and plant residue would retain moisture necessary for the regrowth of grasses, shrubs, and conifer seedlings. Thermal cover would be reduced to some degree, although this may not impact black bear because of their tendency to den in rock or hole structures in canyons and cliff faces. Resource protection measures (measures Wildlife-2, Wildlife-4, Wildlife-5, Wildlife-8, Water-2) would retain a certain amount of hiding and thermal cover in forest and woodland habitats. Most effects on black bear habitat would be beneficial improvements to the quality and quantity of forage—grasses, forbs, shrubs, nuts, acorns, berries, fruits, etc. There would be a beneficial increase in the amount of edge habitat where patches of dense trees are interspersed with small openings, and an improvement in the overall diversity of tree sizes and stand densities throughout the landscape.

Any direct impacts to hiding and thermal cover from treatments would be short term, and black bear could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the vegetation treatments would improve the health and resiliency of woodlands, thereby maintaining or increasing suitable foraging and cover habitat, and overall distribution of black bear. Indirect impacts to black bear, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation. There would be no major long-term impacts to these populations or habitat trends under this alternative.

Effects from the Use of Fire

Under the proposed action, direct impacts to black bear would likely be in the form of large reductions in hiding cover, thereby increasing vulnerability to being killed by hunters. However, there would remain scattered thickets of trees and oak shrubs available for hiding cover. This cover could improve rapidly as the open space provides sunlight and plant residue would retain moisture necessary for the regrowth of grasses, shrubs, and conifer seedlings. Thermal cover would be reduced to some degree, although this may not impact black bear because of their tendency to den in rock or hole structures in canyons and cliff faces. Most effects on black bear habitat would be beneficial improvements to the quality and quantity of forage—grasses, forbs, shrubs, nuts, acorns, berries, fruits, etc. There would be a beneficial increase in the amount of edge habitat where patches of dense trees are interspersed with small openings, and an improvement in the overall diversity of tree sizes and stand densities throughout the landscape.

Any direct impacts to hiding and thermal cover from treatments would be short term, and black bear could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. To mitigate impacts, resource protection measures (measures Rx-4, Wildlife-2, Wildlife-4, Wildlife-5, Wildlife-8) would retain a certain amount of hiding and thermal cover in forest and woodland habitats. In the long term, the vegetation treatments would improve the health and resiliency of woodlands, thereby maintaining or increasing suitable foraging and cover habitat, and overall distribution of black bear. Indirect impacts to black bear, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation. There would be no major long-term impacts to these populations or habitat trends under this alternative.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact black bear in the form of ground-disturbing activities occurring during project implementation. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within black bear habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact black bear. Indirect impacts to black bear from consuming insects and seeds in treated areas are not expected to have a measurable effect on the black bear because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to black bear, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of black bear habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on black bear are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of black bear may occur. Any indirect impacts to black bear from special use authorizations would be short term, and black bear could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to black bear is anticipated as these activities would not be long term in nature. Indirect impacts to black bear, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace black bear in the short term. However, black bear would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to black bear would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Merriam's wild turkey (Meleagris gallopavo merriami)

Alternative 1 – No Action

Under this alternative, there would be no project-related impacts to Merriam's wild turkey, their nest sites, or their habitat in the project area because the project would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. The no action alternative continues a management practice that produces vegetation trends associated with the lack of large, low-intensity surface fires. The lack of natural ground fire would continue to degrade habitat quality within the fire-adapted woodland habitat. In particular, there would be continued declines in large trees due to growth suppression and insect-caused mortality. The no action alternative also creates the possibility of a large-scale, high-intensity wildfire burning though the project area.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on Merriam's wild turkey in the form of habitat disturbance during project implementation. Approximately 53,910 acres of representative Merriam's wild turkey habitat would be treated by vegetation thinning and 108,120 acres would be treated using prescribed fire, which is approximately 6 percent and 12 percent of representative Merriam's wild turkey habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

In the long term, treatments would retain and enhance the optimum cover and forage ratio for Merriam's wild turkeys suitable for the species. It is possible that the creation of diverse habitat features could result in Merriam's wild turkey becoming reestablished or more prolific in the project area. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, this would benefit this species by increasing quality and quantity of habitat that the Merriam's wild turkey uses, as well as improve forest resiliency so that Merriam's wild turkey habitat continues to persist on the landscape. Merriam's wild turkey population trends are expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

The proposed action would thin vegetation, create stand openings, and create canopy openings. These types of structural vegetation changes would be both adverse and beneficial to Merriam's wild turkey. Impacts may be adverse as Merriam's wild turkey depends upon dense vegetation when nesting; however, the density also prevents them from noticing predators. Treatments may affect individuals of Merriam's wild turkey, but would not likely impact forest-wide population trends. Resource protection measures (measures Wildlife-2, Wildlife-4, Wildlife-5, Wildlife-8, Water-2) would retain a certain amount of cover and forage habitats in forest and woodland areas. The proposed treatments within the project area would move habitat towards a more optimal cover and forage ratio, which would improve habitat quality. Stands within the proposed treatment area would be opened as vegetation structural stage classes are shifted to the prescribed age classifications. These openings would provide better forage opportunities as the understory begins to return. More trees would be recruited and retained in the larger tree diameters and thus create the open, mature ponderosa pines required for roost sites.

Under the proposed action, direct impacts to Merriam's wild turkey may remove some nest sites and reducing hiding cover could increase predation or hunter success. However, there would remain scattered thickets of trees and oak shrubs available for hiding cover. Movement of machinery used to conduct thinning operations might disturb nests found at the bases of trees or concealed by understory. Increased noise from thinning operations might disturb flocks and cause them to migrate. Once implementation is completed, cover habitat would improve rapidly as the open space provides sunlight, and plant residue would retain moisture necessary for the regrowth of grasses, shrubs, and conifer seedlings. Most effects on Merriam's wild turkey habitat would be beneficial improvements to the quality and quantity of forage—grasses, forbs, shrubs, nuts, acorns, berries, fruits, etc. There would be a beneficial increase in the amount of edge habitat where patches of dense trees are interspersed with small openings, and an improvement in the overall diversity of tree sizes and stand densities throughout the landscape.

Any direct impacts to hiding cover from treatments would be short term, and Merriam's wild turkey could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the vegetation treatments would improve the health and resiliency of woodlands, thereby maintaining or increasing suitable foraging and cover habitat, and overall distribution of Merriam's wild turkey. Indirect impacts to Merriam's wild turkey such as human disturbance would be localized and short term, resulting from crews and equipment during project implementation. There would be no major long-term impacts to these populations or habitat trends under this alternative.

Effects from the Use of Fire

Under the proposed action, direct impacts to Merriam's wild turkey would likely be in the form of reductions in hiding cover, thereby increasing vulnerability to being killed by hunters. However, there would remain scattered thickets of trees and oak shrubs available for hiding cover. Other direct impacts from prescribed burning may be the removal of some nest sites and the reduction of hiding cover, which could increase predation or hunter success. Prescribed burning in pinyon-juniper habitats may also remove some nest sites, but the overall benefit to the species would be to stimulate the growth of food plants while also reducing litter and exposing seeds and insects, as well as creating edges to increase nesting habitat and reduce brush so that Merriam's wild turkey can be less susceptible to predators (U.S. Forest Service 1996b). Prescribed burns during the spring would potentially destroy Merriam's wild turkey nests and fast-moving fires could kill newly hatched poults, but once their wing feathers begin emerging from their shafts (10 to 14 days), poults can fly short distances and may be able to evade fast-moving fires (U.S. Forest Service 1996b). However, due to the healthy population trend of Merriam's wild turkeys in New Mexico, the proposed action is not expected to contribute to a downward population trend. Movement of machinery used to conduct burning operations might disturb nests found at the bases of trees or concealed by understory. Increased noise from thinning operations might disturb flocks and cause them to migrate. To mitigate impacts, resource protection measures (measures Rx-4, Wildlife-2, Wildlife-4, Wildlife-5, Wildlife-8) would retain a certain amount of cover and forage habitats in forest and woodland areas.

Most effects on Merriam's wild turkey habitat would be beneficial improvements to the quality and quantity of forage—grasses, forbs, shrubs, nuts, acorns, berries, fruits, etc. There would be a beneficial increase in the amount of edge habitat where patches of dense trees are interspersed with small openings, and an improvement in the overall diversity of tree sizes and stand densities throughout the landscape. Any direct impacts to hiding cover from treatments would be short term, and Merriam's wild turkey could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the vegetation treatments would improve the health and resiliency of woodlands, thereby maintaining or increasing suitable foraging and cover habitat, and overall distribution of Merriam's wild turkey. Indirect impacts to Merriam's wild turkey, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation. There would be no major long-term impacts to these populations or habitat trends under this alternative.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact Merriam's wild turkey in the form of ground-disturbing activities occurring during project implementation. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within Merriam's wild turkey habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact Merriam's wild turkey. Indirect impacts from consuming insects and seeds directly after application could impact individual Merriam's wild turkeys and the population, especially if young poults are foraging. However, there would be no long-term impacts as herbicide treatments would not be extensive. Herbicide treatments are not expected to cause a change in population trends on the forest. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to Merriam's wild turkey, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Merriam's wild turkey habitat to the adverse effects of drought. Other activities such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on Merriam's wild turkey are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of Merriam's wild turkey may occur. Any indirect impacts to Merriam's wild turkey from special use authorizations would be short term, and Merriam's wild turkey could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to Merriam's wild turkey is anticipated as these activities would not be long term in nature. Indirect impacts to Merriam's wild turkey, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace Merriam's wild turkey in the short term. However, Merriam's wild turkey would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to Merriam's wild turkey would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Regional Forester Sensitive Species

Sacramento Mountains salamander (Aneides hardii)

Alternative 1 – No Action

Under this alternative, there would be no project-related impacts to Sacramento Mountains salamander or their habitat in the area because the project would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. Under the no action alternative, Sacramento Mountains salamander habitat would continue to be at a high risk of uncharacteristic fire events and insect and disease outbreaks under the current even-aged stand structure of the forest. Stand density-related mortality in the larger trees would continue to increase. This would have negative and positive effects on Sacramento Mountains salamander habitat. The loss of large tree canopy cover would be a loss of that habitat feature, although the salamander would benefit by the increase in numbers of large, downed logs. The numbers of snags and downed logs would also continue to increase as the overgrown stands continue to decline across age classes and from the anticipated high levels of mistletoe and bark beetle infestations. Key elements of the preferred habitat for this species are substantial forest canopies and ground surface cover (downed woody debris), which would be at risk under the no action alternative. Because this alternative proposes no action, direct and indirect impacts to the Sacramento Mountains salamander and habitat would continue to occur through intensive logging, slash removal, and burning which may reduce or eliminate populations of the Sacramento Mountains salamander. The no action alternative does not propose necessary treatments needed for sustaining or enhancing Sacramento Mountains salamander habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on the Sacramento Mountains salamander in the form of habitat disturbance during project implementation. Proposed activities would retain the key habitat requirements for the salamander to maintain habitat suitability. Most treatment activities would only occur when Sacramento Mountains salamanders are protected underground and treatment activities would not occur during extensive rainfall events (i.e., wet periods) when Sacramento Mountains salamanders would most likely be aboveground. Approximately 42,800 acres of representative Sacramento Mountains salamander habitat would be treated by vegetation thinning and 80,200 acres would be treated using prescribed fire. Approximately 13 percent and 25 percent of representative Sacramento Mountains salamander habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, some treatment activities may occur when the ground surface and soils are wet. During these periods, potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, the species habitat would improve, and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to Sacramento Mountains salamander and indirect impacts through loss of habitat, considering the species prefers habitats with forest canopies and plenty of ground surface cover. The thinning treatments involve free thinning of all tree sizes, thin from below, and group selection with matrix thinning between groups. Thinning from below would remove the smallest trees in the understory and fewer of the live overstory canopy. The result would be a reduction in tree density, canopy cover, and shading of the forest floor. Openings would be a maximum of 200 feet wide. Direct impacts of these treatments would reduce the amount of shade and stand density and would affect the microhabitat (e.g., increased temperature and lower humidity) of Sacramento Mountains salamander habitat. Additionally, the more open understory and overstory gaps in the tree canopy would impact habitat by reducing the moisture and increase temperatures on the forest floor, which would slightly reduce quality of the habitat. Sacramento Mountains salamanders would be expected to avoid the warmer, drier openings created on the ground as a result of thinning. However, resource protection measures (measures Wildlife-11, Wildlife-15) and timing restrictions are in place to protect Mexican spotted owl and Sacramento Mountains salamander on these sites by retaining dense clumps of trees and relatively higher overstory canopy cover to provide adequate shading on the forest floor. The retention of downed woody material is an important habitat component for this species and its prey. Where there is overlap with Mexican spotted owl protected activity centers, some Mexican spotted owl and Sacramento Mountains salamander resource protection measures (measures Wildlife-11, Wildlife-15) may be bypassed for treatments to be completed. Treatment activities in these areas will follow guidelines listed above in the vegetation thinning section, however, potential impacts to the species may occur within these areas. The potential disturbance of subterranean retreats for Sacramento Mountains salamanders by the use of heavy equipment may cause a decrease in species numbers in a particular area. The chipping or mastication within occupied habitat may alter fauna within the area. An altered fauna may in return impact the prey species of the Sacramento Mountains salamander. Vegetation treatments associated with the project may increase some sedimentation within Sacramento Mountains salamander habitat and this may create a negative short-term response from the fauna within the area.

Resource protection measures (Wildlife-2, Wildlife-3, Wildlife-7, Wildlife-8, Wildlife-15) would also limit treatments to no more than 4 percent of occupied habitat within a single stand and avoid ground-disturbing activities in occupied habitat, to the greatest practical extent, during the active season for the species (July 1 to September 30) to avoid crushing individual salamanders and compacting soils. Treatment activities will benefit the Sacramento Mountains salamander by increasing the amount of woody debris on the forest floor to improve soil moisture and microhabitat quality. The overall changes in humidity, soil moisture, and temperature would be minimal and not substantially impact potential suitability of the habitat. Within a year following thinning treatments, there would be a substantial increase in the abundance of grasses and forbs, especially in the small canopy gaps. Increases in grasses and forbs in the understory would increase substrate for the ground-dwelling arthropod prey species of Sacramento Mountains salamanders. Downed logs and wood are key habitat features and thinning would not remove existing downed logs, but would generate additional downed logs and woody material (tree stems and branches). There would be sufficient downed logs and woody material to maintain or enhance Sacramento Mountains salamander habitat and insect food sources in this area. Snags are considered future downed logs, as they eventually fall to the ground. Resource protection measures are also built into the project and address the need to retain large trees and snags to provide wildlife habitat (measures Wildlife-2, Wildlife-3, Wildlife-7, Wildlife-8, Wildlife-15). The snags retained within the project area, combined with the snags in adjacent untreated forest stands, would likely result in continuation of snag abundance within potential and occupied Sacramento Mountains salamander habitat. Thus, large logs and downed wood should continue to remain abundant in the future as snags fall to the ground over time.

Effects from the Use of Fire

The effects of the restoration methods and associated activities of the project could have a direct impact to Sacramento Mountains salamander and indirect impacts through loss of habitat, considering the species prefers habitats with forest canopies and ground surface cover. All prescribed burn treatment areas within Sacramento Mountains salamander habitat would only be low-intensity surface burns. Direct impacts of prescribed burning would temporarily reduce the soil moisture available for the Sacramento Mountains salamander and its prey species for the first year. Prescribed burning will consume some of the existing downed woody material. The mosaic pattern of the burn will also open some of the canopy within occupied habitat. The burning prescriptions will primarily focus on removing small-diameter trees, occasionally removing larger size classes. Prescribed fire will lead to downed woody material recruitment that the Sacramento Mountains salamander will utilize and will also offset any potential loss of existing downed woody material. The prescribed fire will lead to greater fauna diversity that its prey will utilize as well. This will in return improve the foraging habitat of the Sacramento Mountains salamander. Retaining the larger trees will help maintain cool moist microclimates and help create habitat conditions that this species needs. Grasses and forbs would rapidly grow in and replenish the soil moisture, along with the additional downed wood left from thinning. Within 5 years, there would additionally be new tree seedlings and more mature plants on the forest floor, substantially improving the microclimate and forest floor habitat conditions for the Sacramento Mountains salamander. The fire-charring of downed logs from prescribed burns may harden parts of the logs and reduce their rate of deterioration. This may slightly reduce potential abundance of insects and other invertebrate prey species (Pilliod and others 2006).

The Sacramento Mountains salamander has been known to survive in sites where fire impacted salamander habitat, most likely because they spend most of their time underground and these areas also have had plenty of downed woody material after the live trees became snags and then finally fell to the ground. In addition, where there was a lack of canopy cover from conifer, the oak gave some form of cover (U.S. Forest Service 2014c). However, surveys in each burn site would be necessary to determine if fire has any long-term effects on future populations (U.S. Forest Service 2014c). In addition, surveying in all and new sites where fire did occur is necessary to determine habitat rehabilitation and Sacramento Mountains salamander presence in accordance with the resource protection measures (measures Rx-4, Rx-8, Wildlife-2, Wildlife-3, Wildlife-7, Wildlife-8, Wildlife-15).

Indirect effects may occur in the form of habitat loss through erosion or the use of heavy equipment causing soil compaction. Although heavy equipment use within the project area is not likely to have a direct impact to the Sacramento Mountains salamander (due to avoidance and timing of implementation), heavy equipment used to implement the project could lead to an increase in site disturbance, which may lead to soil compaction, erosion, and the introduction and/or spread of nonnative invasive species. Resource protection measures and timing restrictions are in place to protect Mexican spotted owl and Sacramento Mountains salamander (measures Wildlife-11, Wildlife-15) on these sites by retaining dense clumps of trees and relatively higher overstory canopy cover to provide adequate shading on the forest floor. Habitats with dense mixed conifer and aspen forests within the elevational range of the species would be maintained within the existing stands as well as ground surface cover such as rocks, logs, and organic material. Resource protection measures (measures Wildlife-2, Wildlife-3, Wildlife-7, Wildlife-8) would also limit treatments to no more than 40 percent of occupied habitat within a single stand and avoid ground-disturbing activities in occupied habitat, to the greatest practical extent, during the active season for the species (July 1 to September 30) to avoid crushing individual salamanders and compacting soils. Slash-burn piles should not be completed in potential habitat areas due to Sacramento Mountains salamander activity. Timing restrictions may also limit impacts to individual salamanders as they are known to move deeper underground after September. Although it is unknown how far Sacramento Mountains salamander travel underground, burning of slash piles will adversely affect the salamander populations beneath the surface (U.S. Forest Service 2014c).

Based on the overall benefits of the proposed action, i.e., reducing the potential for uncharacteristic high-severity fires and improving forest health, habitat for the Sacramento Mountains salamander is assumed to be improved and/or restored. It is possible that the creation of diverse habitat features could result in the species becoming reestablished or more prolific in the project area. Ramotnik and others (2007) found that recolonization of the site after fire would be possible only after canopy cover develops, depth of litter increases, large natural cover objects return, and soil moisture returns to become suitable habitat. She also found it took 3 years for soil pH to decrease after sites have burned. This characteristic is important because soil moisture can influence the ability of Sacramento Mountains salamanders to repopulate burned sites.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact Sacramento Mountains salamander in the form of ground-disturbing activities occurring during project implementation. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within Sacramento Mountains salamander habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact Sacramento Mountains salamander. Indirect impacts to Sacramento Mountains salamander from consuming insects in treated areas are not expected to have a measurable effect on Sacramento Mountains salamander because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to Sacramento Mountains salamander, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Sacramento Mountains salamander habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on Sacramento Mountains salamander are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of Sacramento Mountains salamander may occur. Indirect impacts to Sacramento Mountains salamander from special use authorizations would be short term, and may impact individual Sacramento Mountains salamanders as this species has a high site fidelity and may not be able to move to other parts of the Lincoln National Forest during forest industry activities occurring in the project area. Although this species is known for site fidelity, resource protection measures are in place to help minimize impacts to individual and local populations. No long-term impact to Sacramento Mountains salamander is anticipated as these activities would be highly localized. Indirect impacts to Sacramento Mountains salamander, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace Sacramento Mountains salamander in the short term. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. Human disturbance to Sacramento Mountains salamander would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. However, these activities may impact individual Sacramento Mountains salamanders as this species has a high site fidelity and may not be able to move to other parts of the Lincoln National Forest during road management occurring in the project area.

Determination of Effects

Given that overall habitat conditions would be improved in the long term, it is expected that the population trend for the Sacramento Mountains salamander on the Lincoln National Forest would remain stable under the proposed action. Additionally, the proposed vegetation treatments have been designed to retain and promote future development of suitable habitat. The resource protection measures (described in Chapter 2, Section 2.2.5) would be implemented to minimize impacts to the Sacramento Mountains salamander. This project **may impact individuals, but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for Sacramento Mountains salamander on the Lincoln National Forest are expected to remain stable, if not trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted in the short term, but the majority of the species population will be maintained and will recover quickly.

Northern goshawk (Accipiter gentilis)

Alternative 1 – No Action

Under this alternative there would be no impact to northern goshawks or their habitat from the proposed project because proposed activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no northern goshawk habitat disturbance that could otherwise result under action alternatives from reopening closed roads, mechanical thinning, prescribed burning, and increased vehicle use. There would be no reduction in canopy cover in the vegetation structural stage 4 to 6 stands or groups, except where tree mortality continues to cause a loss of the larger trees and increasing the probability of landscape-wide, high-intensity wildfires. The current conditions and trends would continue to have some detrimental consequences to northern goshawk nesting and roosting habitat as well as foraging habitat. There would continue to be fewer large trees as they would continue to be growth suppressed and die out prematurely due to the severe competition for moisture, light, and nutrients. The absence of fire allows the buildup of both surface fuels and seedlings and those seedlings begin to dominate the landscape as large trees die and are not replaced. Prescribed fire reduces those surface fuels and seedlings which helps recruitment into the larger vegetation structural stage classes. Without prescribed fire, the resilience and sustainability of these fire-adapted ecosystems would continue to decline. There would continue to be a lack of vegetation structural stage 1 grass, forb, and shrub habitat components. Historic meadows and shrublands would continue to be encroached by conifer trees. In addition, white fir would continue to dominate mixed conifer rather than the fire-resistant pine and Douglas-fir trees. As a consequence of all these conditions and trends, the area would remain very susceptible to a large high-intensity wildfire and loss of suitable northern goshawk habitat.

Under the no action alternative, the ecological response units would exhibit a continuing high competition for resources, poor individual tree vigor and growth, and a continuation of poor overall forest health conditions and a decreasing resilience to insects and disease. The high risk of insect and disease would not be lowered relative to existing insect and disease risk. In the absence of restoration treatments, the mixed conifer with aspen ecological response unit is predicted to remain within an unhealthy condition relative to desired conditions as the homogeneous stand structure is perpetuated, with a predominance of young and medium-aged trees in dense stands, with high numbers of trees per acre and few old-growth trees. In the long term (decades), stand structure would become more homogeneous with more even-aged trees, creating an adverse impact to forest and woodland health and impacting forest resiliency to insect and disease. Under these conditions, individual northern goshawks and habitat would continue to be at a high risk of uncharacteristic fire events under the current even-aged stand structure of the forest. This is not likely to result in a trend toward federal listing or loss of viability for the northern goshawk population as a whole.

Overall, impacts of this alternative would be detrimental to the habitat conditions as well as the reproduction success of individual northern goshawks in this area.

As mentioned above, existing northern goshawk habitat does not currently follow vegetative structural stage recommendations from Reynolds and others (2013) within each of the ecological response units. Under the no action alternative, ecological response units in the project area would continue to degrade and become more unsuitable for northern goshawk. Over time the current northern goshawk habitat within the project area would further increase the acres of dense stand structure with high numbers of trees per acre, high basal areas, and over 50 percent canopy cover, increased seedling small state areas, high fuel loading of surface and canopy fuels, low crowning and torching index, and significant departure from historical fire regime. These conditions illustrate a nearly static, stagnated condition of the forest and have the potential to contribute to high competition for resources, poor individual tree vigor and growth, a continuation of poor overall forest health conditions, decreasing resilience to insects and disease, and contributing to large fire size and high fire intensity and severity across the landscape.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action may impact individual northern goshawks, but is not likely to result in a trend toward federal listing or loss of population viability. Short-term adverse effects on the northern goshawk in the form of habitat disturbance may occur during project implementation, but key habitat requirements for the northern goshawk would be retained to maintain habitat suitability. Approximately 42,800 acres of representative northern goshawk habitat would be treated by vegetation thinning and 80,200 acres would be treated using prescribed fire, which is approximately 13 percent and 25 percent of representative northern goshawk habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be minimized through the application of the resource protection measures that are called out in the text below and timing restriction during the breeding season (see Chapter 2, Section 2.2.5). The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, the species habitat would improve, and individuals could expand into previously unoccupied areas. Relative to the existing habitat conditions for the northern goshawk mentioned previously, the effects of implementing the proposed action are presented below in Table 3-33, Table 3-34, and Figure 3-31 and Figure 3-32 for Mixed Conifer with Aspen, Mixed Conifer-Frequent Fire Forest, and ponderosa pine ecological response units.

Table 3-33 and Figure 3-31 describe the redistribution of acres of mixed conifer with aspen stands between each state under the no action alternative and proposed action, relative to the existing condition. Generally, the proposed action would result in more open stands with less interlocking canopies, with fewer small-diameter trees and a greater proportion of larger-diameter older trees within the mixed conifer with aspen stands ecological response unit. Implementing the proposed action will benefit the northern goshawk by moving stands from the medium seral state, into the large open canopy state, and from a vegetative structural stage class of 3 and 4 to a vegetative structural stage class of 5 and 6. The average trees sizes are increased, trees per acre are reduced, densities and basal areas are reduced, and canopy cover is decreased. In addition, by opening up the stands, breaking up the continuity of vegetation and fuels and increasing heterogeneity of tree age and size classes within the ecological response unit, treatments would improve the overall health and resiliency of residual stands to insect, disease, and other disturbances in the long term (greater than 2 years). Treatments would thereby benefit the northern goshawk by promoting the long-term (greater than 2 years to decades) health and vigor of residual trees in larger size classes.

Table 3-33. Indicators for the Mixed Conifer with Aspen Ecological Response Unit under the No Action and Proposed Action, Relative to the Existing Condition

Mixed Conifer with Aspen Seral Stage	Acres Year 0	Acres No Action Year 20	Acres Proposed Action Year 20	Vegetative Structural Stage	Trees per Acre	Basal Area (square feet per acre)	Canopy Cover (%)	Fuel Loading (tons/acre)
Aspen	4,590	3,259	3,239	3	723	148	68	62
Very Large Closed	178	3,351	2,240	5/6	278	163	46	65
Very Large Open	34	334	3,587	5/6	88	85	20	92
Medium	17,025	13,959	10,296	3/4	393	168	53	62
Seedling/Small	4,185	5,048	6,293	2	335	49	27	45
Grass/Brush	58	120	416	1	36	5	4	30
Total	**26,070**	**26,070**	**26,070**					

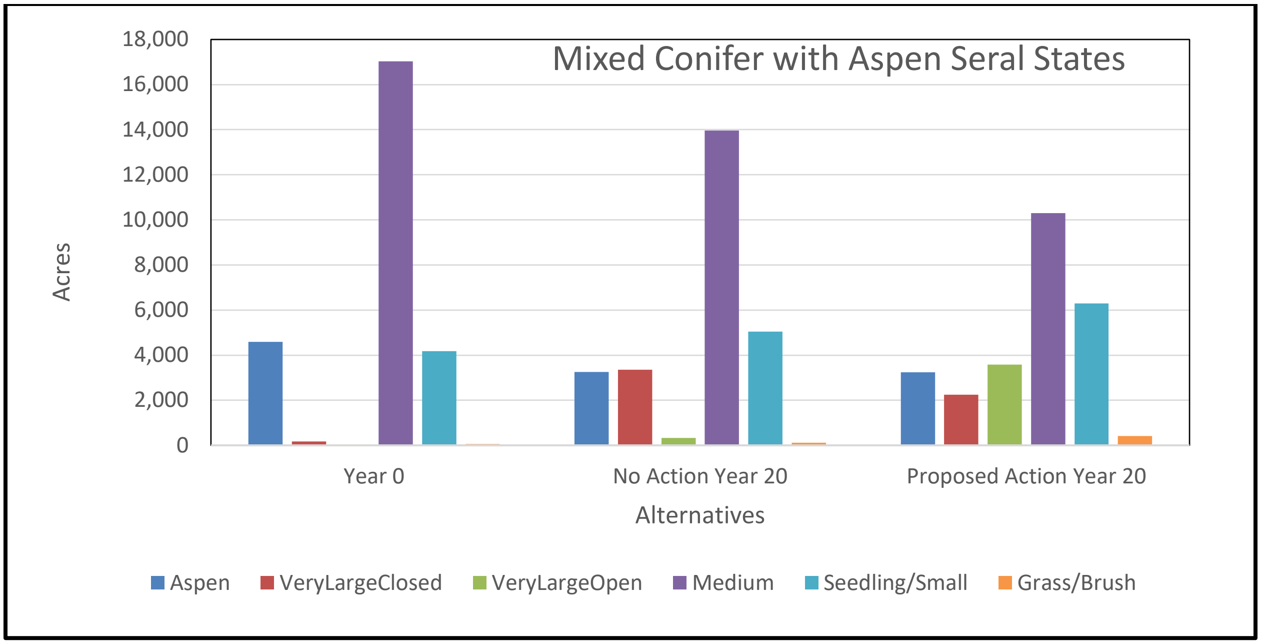

Figure 3-31. Composition of seral states for Mixed Conifer with Aspen within the South Sacramento Restoration Project Area under the no action and proposed action, relative to the existing condition (Year 0).

Table 3-34 and Figure 3-32 describe the redistribution of acres of mixed conifer-frequent fire forest states between each seral state under the no action and proposed action, relative to the existing condition. Generally, this means that the proposed action would result in more open stands with less interlocking canopies, with fewer small-diameter trees and a greater number of larger-diameter older trees within the mixed conifer-frequent fire forest ecological response unit. Implementing the proposed action will benefit the northern goshawk by shifting the single age class towards greater acreage within the medium large open multistory and medium large open single-story vegetative structural stage classes. This will increase grass/brush/sapling acreage due to the openings of the canopy. The resulting forest vegetative structural stage class more closely resemble the desired conditions for the mixed conifer-frequent fire forest ecological response unit and more suitable habitats for the northern goshawk. The proposed action would result in a mosaic of vegetative structural stage classes, greater “clumpiness” and a more functional ecosystem containing a multistory structure promoting increased resilience to disturbance, climate variability, and disease. The heterogeneous structure provides greater habitat variability and structural components for nesting and foraging for the northern goshawk. Reductions in tree densities would also result in more sunlight and plant nutrient resources for northern goshawk prey.

Table 3-34. Indicators for the Mixed Conifer-Frequent Fire Ecological Response Unit Under the No Action Alternative and Proposed Action, Relative to the Existing Condition

Mixed Conifer Frequent Fire Seral Stage	Acres Year 0	Acres No Action Year 20	Acres Proposed Action Year 20	Vegetative Structural Stage	Trees per Acre	Basal Area (square feet per acre)	Canopy Cover (%)	Fuel Loading (tons/acre)
Medium Large Closed	41,288	40,243	18,120	3/4/5	379	172	54	53
Medium Large Open Multi-Story	859	558	13,824	4/5	238	66	25	19

Mixed Conifer Frequent Fire Seral Stage	Acres Year 0	Acres No Action Year 20	Acres Proposed Action Year 20	Vegetative Structural Stage	Trees per Acre	Basal Area (square feet per acre)	Canopy Cover (%)	Fuel Loading (tons/acre)
Medium Large Open Single Story	2,170	1,377	7,800	4	148	65	23	17
Small Closed	689	3,587	3,050	3	660	156	62	41
Small Open	2,676	56	188	2	180	45	21	45
Grass/Brush/Sapling	9,931	11,791	14,629	1	723	84	44	33
Total	**57,613**	**57,612**	**57,611**					

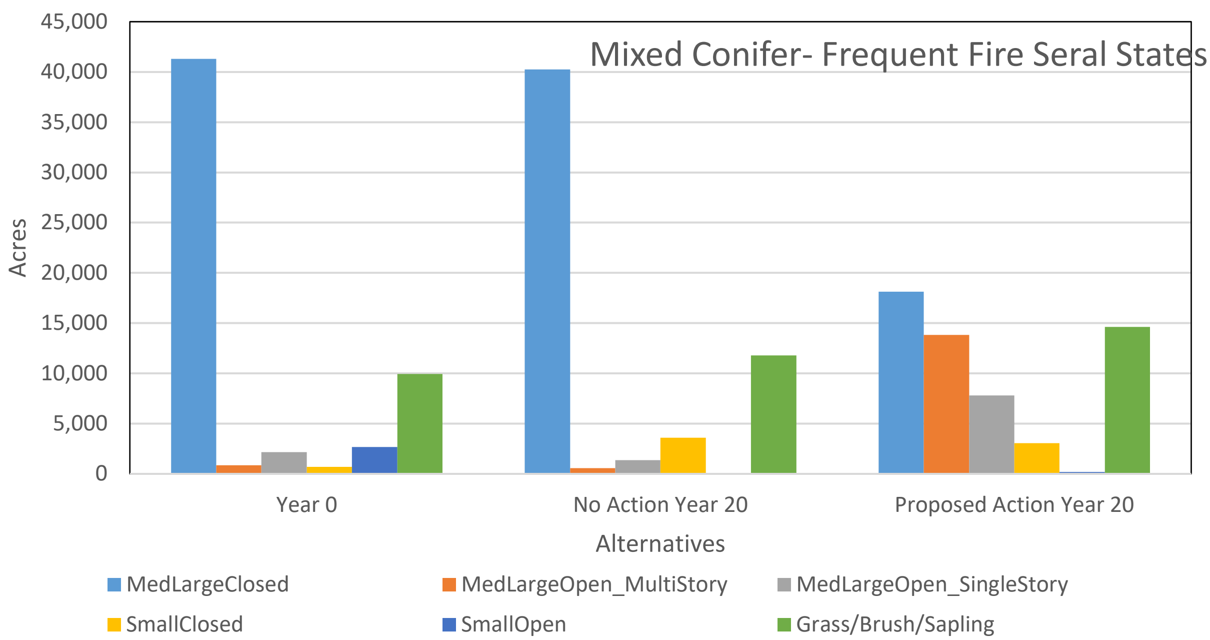

Figure 3-32. Composition of seral states for Mixed Conifer-Frequent Fire within the South Sacramento Restoration Project Area under the no action and proposed action, relative to the existing condition.

Table 3-35 and Figure 3-33 describe the redistribution of acres of ponderosa pine states between each state under the no action alternative and proposed action, relative to the existing condition. Generally, this means that the proposed action would result in forests with more diversity in age and size classes, with more open states and a higher number of larger, older trees instead of a predominance of young small-diameter trees in the understory within the ponderosa pine ecological response unit. The resulting forest vegetative structural stage class more closely resemble the desired conditions for the ponderosa pine forest ecological response unit and will be more variable, compared with the existing condition. This will create more suitable habitats for the northern goshawk. Reductions in tree densities would result in more sunlight and plant nutrient resources for other native plant species, especially understory plants, similar to desired historic reference conditions. Treatments would result in reduced trees per acre, improving species composition and meeting desired conditions for stand density. Open stand structures would favor maintaining larger trees, especially shade-intolerant species like Douglas-fir and ponderosa pine and old growth. Tree vigor and growth would be enhanced by the application of all treatments. The proposed action would result in a mosaic of vegetative structural stage classes, greater "clumpiness" and a more functional ecosystem containing a multistory structure promoting increased resilience to disturbance, climate variability, and disease. The heterogeneous structure provides greater habitat variability and structural components for nesting and foraging for the northern goshawk.

Table 3-35. Indicators for the Ponderosa Pine Forest Ecological Response Unit Under the No Action and Proposed Action, Relative to the Existing Condition

Ponderosa Pine Forest Seral Stage	Acres Year 0	Acres No Action Year 20	Acres Proposed Action Year 20	Vegetative Structural Stage	Trees per Acre	Basal Area (square feet per acre)	Canopy Cover (%)	Fuel Loading (tons/acre)
Medium Large Closed	7,079	7,352	2,694	3/4/5	348	168	50	17
Medium Large Open Multi Story	190	284	3,277	4/5	185	70	24	8
Medium Large Open Single Story	749	513	1,858	4	97	58	21	10
Small Closed	580	3,112	1,875	3	691	147	55	13
Small Open	2,180	841	2,076	3	217	45	23	10
Grass/Brush/Saplings	3,603	2,279	2,601	2	733	75	37	6
Total	**14,381**	**14,381**	**14,381**					

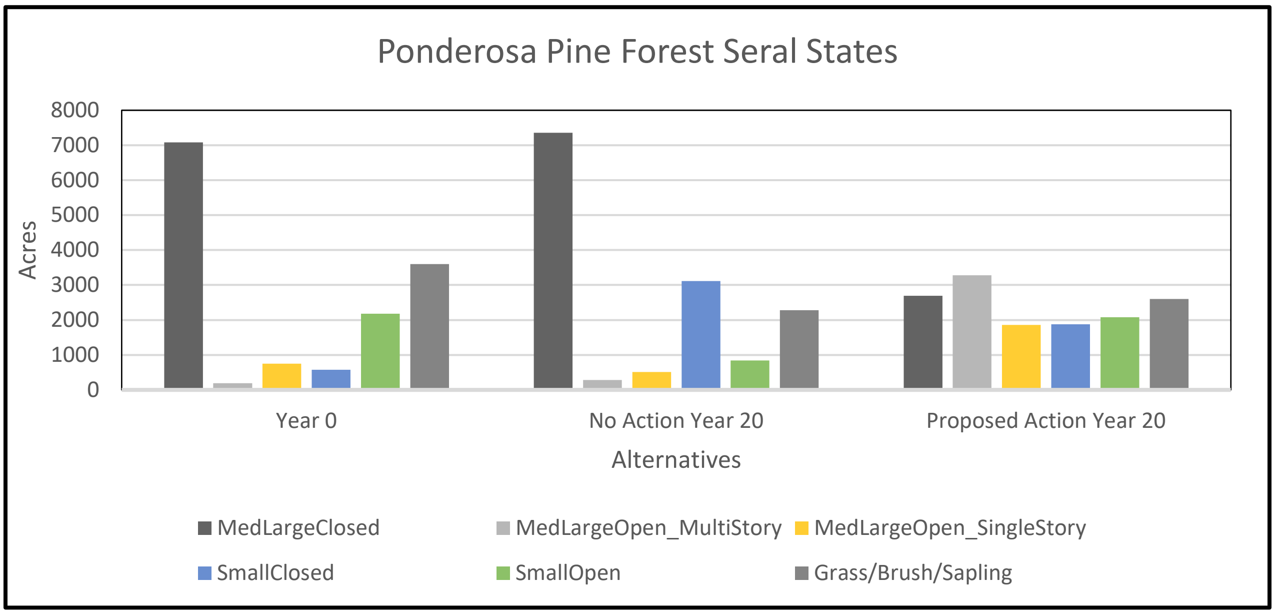

Figure 3-33. Composition of seral states for Ponderosa Pine Forest ecological response unit within the South Sacramento Restoration Project Area under the no action and proposed action, relative to the existing condition.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to northern goshawk and indirect impacts through loss of habitat, considering the species prefers ponderosa pine and mixed conifer forest habitats. The thinning treatments involve free thinning of all tree sizes, thin from below, and group selection with matrix thinning between groups. Thinning from below would remove the smallest trees in the understory and fewer of the live overstory canopy. Tree species composition would also move towards a more desired mix of species. There would be more fire-adapted species, such as ponderosa pine and Douglas-fir, and fewer white fir species that tend to torch easily in surface fires. Retaining large ponderosa pine and Douglas-fir trees is preferred in northern goshawk habitat. Group selection with matrix thinning would result in tree density variability across the treatment area and within stands. Groups would be select to remove excess young and mid-aged vegetation structural stage groups, retaining proportionally more mature and old-growth groups creating more balanced uneven-aged stand structure. Thinning within groups would promote a multistory condition by more equally distributing trees among the various size classes, retaining healthier, more vigorous trees that will produce more cones and a greater frequency of cone crops, an important food base for prey species. Likewise, interspaces would provide habitat for additional prey species favored by the northern goshawk. All of these actions will benefit the northern goshawk and enhance northern goshawk habitat.

Removal of some large trees would be permitted according to recommendations from Reynolds and others (2013) and would follow the recommended number per acre to retain the groupy/clumpy, mosaic pattern of forest patches. These treatments, which will occur during the breeding season, will impact breeding success and may impact individuals. In addition, surveys for nest locations would be required prior to implementation. Potential nest tree and prey habitat would be lost by removing large trees. The removal of these trees would create small opening (typically 0.25 to 2 acres in size) scattered throughout the treatment area. Grasses, forbs, and shrubs would increase in these small openings. These small openings would enhance foraging habitat for the northern goshawk. Most snags 18 inches DBH and up would be retained, and would eventually contribute to the amount of downed woody material. By meeting snag and woody debris retentions, as required in the Forest Plan and described in the resource protection measures (measures Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8, Wildlife-9, Wildlife-10, Wildlife-14), prey and foraging habitat would be maintained across the project area. Where canopy cover would decrease as a result of tree removal, sunlight would stimulate the growth of grasses, forbs, and understory shrubs. Pockets of grasses, forbs, and understory shrubs intermixed within forested habitat would promote the diversity of prey species and foraging habitat of northern goshawks.

Treatments would create a greater diversity of ages, sizes, and densities of trees, along with an increase in the abundance of grasses, forbs, and shrubs. The clumpy, mosaic pattern of forest patches would resemble historic patterns left by historic surface fire regimes, with patches of larger trees and higher stand densities on moist north- and east-facing slopes and in drainage bottoms, and lower densities on the drier, south- and west-facing slopes, along ridgetops, and along the community boundary (Hanks and Dick-Peddie 1974; Reynolds and others 2013). Treatments would also improve the forest species composition, moving conditions closer to historic conditions considered to be more sustainable over time. There would be fewer white fir trees and greater dominance by large ponderosa pine and Douglas-fir trees that can withstand frequent surface fires without promoting stand-replacing wildfire behavior.

Noise disturbance from thinning may impact northern goshawk nesting or reproductive success within nesting areas during the breeding season (March 1 to September 30), except where treatments overlap with Mexican spotted owl protected activity centers. If treatment activities are planned where post-fledgling family areas overlap with Mexican spotted owl recovery habitat (assuming Mexican spotted owl presence), then noise disturbance could potentially disturb northern goshawks. Noise and visual disturbance from activities outside the post-fledgling family areas and breeding season are not expected to have an adverse impact to the northern goshawks foraging use of the project area, although northern goshawks may temporarily avoid portions of the project area where activities are being conducted. Based on the overall benefits of the proposed action, i.e., reducing the potential for uncharacteristic, high-severity fires, improving forest health, and diversifying habitat conditions across the project area, habitat for the northern goshawk is assumed to be improved and/or restored. It is possible that the creation of diverse habitat features could result in the northern goshawk's becoming reestablished or more prolific in the project area.

Effects from the Use of Fire

The restoration methods and associated activities of the project could have a direct impact to northern goshawk and indirect impacts through loss of habitat, considering the species prefers ponderosa pine and mixed conifer forest habitats. However, prescribed, low-intensity surface fire would result in increased structural complexity and habitat heterogeneity (Pilliod and others 2006). Prescribed fire would reduce litter, ground cover, the finer pieces of downed woody debris and the small trees. Prey habitat would be increased as grasses, forbs, and shrubs fill into canopy openings. The initial, first year reduction in understory vegetation would increase prey vulnerability and temporarily increase foraging opportunities for goshawks. Following prescribed fire, the ground vegetation would rapidly recover. Plant diversity, prey habitat, and prey abundance would be expected to increase as well. Prescribed fire would likely increase the number of small-diameter snags. Fire-killed trees would eventually fall, increasing the amount of downed woody material and prey habitat for northern goshawks. Trees will produce more cones and greater frequency of cone crops, an important food base for prey species. Likewise, interspaces would provide habitat for additional prey species favored by the northern goshawk. All of these actions will benefit the northern goshawk and enhance northern goshawk habitat.

Over time, treatments would create a greater diversity of ages, sizes, and densities of trees, along with an increase in the abundance of grasses, forbs, and shrubs. The clumpy, mosaic pattern of forest patches would resemble historic patterns left by historic surface fire regimes, with patches of larger trees and higher stand densities on moist north- and east-facing slopes and in drainage bottoms, and lower densities on the drier, south- and west-facing slopes, along ridgetops and along the community boundary (Hanks and Dick-Peddie 1974). Treatments would also improve the forest species composition, moving conditions closer to historic conditions considered to be more sustainable over time. There would be fewer white fir trees and, thus, greater dominance by large ponderosa pine and Douglas-fir trees that can withstand frequent surface fires without promoting stand-replacing wildfire behavior.

Direct impacts from prescribed burns and managed wildfires may remove some nest trees. However, the direct effects associated with this treatment on habitat will be short term due to the resource protection measures (measures Rx-4, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8, Wildlife-9, Wildlife-10, Wildlife-14) associated with the proposed action (e.g., retaining snags, burning parameters). Prescribed burning can affect the species through smoke by sight obstruction and inhalation. Prescribed burning may displace individuals during treatment operations if nest trees were burned down during the breeding season. Resource protection measures (measures Rx-4, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8, Wildlife-9, Wildlife-10, Wildlife-14) would limit this potential effect by emphasizing the retention of the largest tree(s) and snags possible to meet forest plan direction of three snags greater than 18 inches in DBH per acre. This project does not target the removal of snags but proposes the recruitment and retention of snags. The retention of large trees and snags would allow adequate nesting and foraging habitat during and after project implementation.

Indirect effects, such as noise disturbance from prescribed burns may impact northern goshawk nesting or reproductive success within nesting areas during the breeding season (March 1 to September 30). Where northern goshawk and Mexican spotted owl habitats overlap, treatment activities would follow guidelines listed above in the vegetation thinning section. However, impacts to the species may also occur in treatment areas within Mexican spotted owl protected activity centers where treatments are authorized to occur during breeding season. These impacts may reduce some nesting success during and after the initial implementation within the project area by altering nesting behavior or its habitat.

Noise and visual disturbance from activities outside the post-fledgling family areas and breeding season are not expected to have an adverse impact to the northern goshawks foraging use of the project area, although northern goshawks may temporarily avoid portions of the project area where activities are being conducted. The burning associated with the proposed action will serve as a recruitment tool for snags within the project area and offset any loss of snags during implementation. Snag recruitment will also create opportunities for this species to forage. Based on the overall benefits of the proposed action, i.e., reducing the potential for uncharacteristic, high-severity fires, improving forest health, and diversifying habitat conditions across the project area, habitat for the northern goshawk is assumed to be improved and/or restored. It is possible that the creation of diverse habitat features could result in the northern goshawk's becoming reestablished or more prolific in the project area.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact northern goshawk in the form of ground-disturbing activities occurring during project implementation. If treatments within the project area occur during and after the breeding season, nesting behavior and success may be reduced during the initial implementation. Where northern goshawk and Mexican spotted owl habitats overlap, treatment activities would follow guidelines listed above in the vegetation thinning section. However, resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within northern goshawk habitat. Impacts to northern goshawk from the herbicides would be mitigated by only using those that are U.S. Environmental Protection Agency–registered for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Indirect impacts to northern goshawk, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15 through Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of northern goshawk habitat to the adverse effects of drought. Other activities such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on northern goshawk are expected as forest industry activities will not be placed near northern goshawk nests; resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for the northern goshawk and wildlife; and the siting criteria in the proposed action are followed. However, indirect impacts such as displacement of northern goshawk may occur. Any indirect impacts to northern goshawk from special use authorizations would be short term, and northern goshawk could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to northern goshawk is anticipated as these activities would not be long term in nature. Indirect impacts to northern goshawk, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace northern goshawk in the short term. However, northern goshawk would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Human disturbance to northern goshawk would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Currently, there are no landings and temporary roads proposed to cross through northern goshawk post-fledgling family areas, to the extent practicable. However, if road management treatments are proposed that cross through northern goshawk post-fledgling family areas, potential adverse effects on breeding success and nest avoidance would be mitigated through the application of the resource protection measures for breeding season restrictions (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15). These resource protection measures may be bypassed if northern goshawk nest stands are within proposed treatment areas within Mexican spotted owl protected activity centers. In addition, acres in the project area cleared for landings and temporary roads may provide some foraging habitat for northern goshawks after the project is completed and the temporary roads and landings have been revegetated. Nesting habitat would be unavailable in cleared areas for over 50 years. These temporary roads are for the removal of forest products only, and open for administrative use only.

Determination of Effects

Under the proposed action, treatments would reduce canopy cover below northern goshawk guidelines both outside and inside post-fledgling family areas. Some important northern goshawk habitat components such as snags and downed woody debris would be reduced in the short term. However, a multistory condition would be promoted, and trees of various size classes would be more equally distributed throughout the project area. Treatments would retain structural diversity by creating a mosaic of dense small groups of the various size classes of trees, inter-mixed with more openly spaced trees. This heterogeneous structure will provide greater habitat variability and structural components for nesting and foraging habitat for the northern goshawk.

Overall, treatments proposed would move toward achieving vegetative structure stage distribution standards for northern goshawks according to General Technical Report-Rocky Mountain Research Station-310 (Reynolds and others 2013). Implementing the proposed action will benefit the northern goshawk by opening up the stands, breaking up the continuity of vegetation and fuels, and increase the heterogeneity of tree age and size classes within the ecological response units. This will also improve the overall health and resiliency of residual stands to insect, disease, and other disturbances in the long term. Treatments would thereby benefit the northern goshawk by promoting the long-term (greater than 2 years to decades) health and vigor of residual trees in larger size classes.

The proposed vegetation treatments have been designed to retain and promote future development of suitable northern goshawk habitat. Resource protection measures as described above would be implemented to avoid and reduce impacts to the northern goshawk and its habitat. This project **may impact individuals, but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for northern goshawk individuals on the Lincoln National Forest are considered short term, and populations are expected to remain stable, if not trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

Gray vireo (Vireo vicinior)

Alternative 1 – No Action

Under this alternative, there would be no project-related effect on gray vireo habitat or population trends because the proposed project activities would not be implemented in this project area. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. However, the vegetation trends associated with the lack of large, low-intensity surface fires would continue to degrade habitat quality within the fire-adapted woodland habitat. In particular, there would be continued declines in large trees due to growth suppression and insect-caused mortality. The lack of large-diameter, mature junipers with snags within a mostly open canopy habitat would continue to decrease over time without management or disturbance. These trends may affect individual birds, although the gray vireo habitat and forest-wide population trends would likely continue to remain relatively stable.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on gray vireo in the form of habitat disturbance during project implementation. Approximately 10,110 acres of representative gray vireo habitat would be treated by vegetation thinning and 26,720 acres would be treated using prescribed fire, which is approximately 2 percent and 5 percent of representative gray vireo habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). In the long term, treatments would promote growth of smaller, residual trees to become large, mature trees with canopy cover suitable for the species. Treatments would also retain and create natural cavities and help maintain a mix of suitable nesting and foraging habitat for the gray vireo. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas. Overall, in the long term, this would benefit this species by increasing the quality and quantity of habitat that the gray vireo uses, as well as improve forest resiliency so that gray vireo habitat continues to persist on the landscape. The gray vireo population trend is expected to increase with implementation of the proposed action.

Effects from Vegetation Thinning

The proposed action would improve nesting and foraging habitat for the gray vireo by reducing tree densities, creating opening canopies, and promoting development of larger trees, snags, and other old-growth components in pinyon-juniper vegetation habitats. Treatments are designed to maintain or enhance mature and old-growth characteristics, with variable densities and size classes, which would maintain or enhance habitat requirements for the gray vireo. Direct impacts from the proposed action may displace individuals during treatment operations if nest trees were cut down during the breeding season. Resource protection measures (measures Wildlife-2, Wildlife-4, Wildlife-9, Water-2) required in the proposed action would limit this potential effect by emphasizing the retention of pinyon-juniper trees within habitat and considering modifications to treatments to protect and retain nest trees in stands during treatments. Ground-disturbing activities occurring during the breeding season may reduce some nesting success during and after the initial implementation within the project area. If any treatments occur during the breeding season (April through August), nesting behavior may be altered. The mechanical thinning will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire.

Vegetation thinning would focus on removing the least-healthy trees and favor early-succession species in stands of pinyon-juniper woodlands or juniper savannah with shrub and grass components, regardless of size, that have been reduced due to competition and struggle for water, nutrients, and sunlight. Free thinning would also be used as a sanitation treatment in stands that have a high level of dwarf mistletoe infection, where at least half of the host trees are infected and group selection treatments are determined to be ineffective at controlling the level of infection because of the general widespread nature of the infection. Approximately 8,400 acres would be restored using this thinning treatment. Free thinning treatment is only proposed on 100 acres of pinyon-juniper grassland habitat out of 110 acres within the project area; this treatment is not proposed at all in the 10,000 acres of pinyon-juniper woodland in the project area.

Any direct impacts from treatments may affect individual gray vireo but are not likely to impact the forest-wide population or habitat trends. Impacts would be short term, and individuals could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. Indirect effects of the proposed action would create a more natural diversity of ages among stands. This will create an opportunity for more trees to move into the mature class that are required nesting habitat for the gray vireo. This will also reduce the possibility of a stand-replacing wildfire that would result in high mortality and alter the age classes diversity of regenerating stands of trees. Some nesting may be displaced during treatment. In the long term, thinning treatments would increase habitat for gray vireo through development of larger trees, snags, open canopies, and other old-growth components in pinyon-juniper vegetation habitats. Providing adequate habitat would in turn support the gray vireo population trends. Resource protection measures are also built into the project and address the need to retain large trees and snags to provide wildlife habitat. In pinyon-juniper habitat, resource protection measures (measures Water-2, Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10) will retain a minimum of one large tree (at least 12 inches diameter at root collar) per 3 acres. In areas with alligator juniper, two alligator junipers per acre would be retained. The resource protection measures will emphasize the retention of the largest tree(s) possible (measures Water-2, Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10). Thinning treatments and resource protection measures (measures Water-2, Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10) will help retain mature and senescent trees within pinyon-juniper habitat while improving overall habitat conditions and resilience to drought and insects and disease. Considering that the gray vireo population on the Lincoln National Forest is minimal, the proposed action would improve habitat conditions and increase potential opportunities for gray vireo to move into the project area.

Effects from the Use of Fire

Direct impacts from prescribed fire treatments could burn up nest trees if treatments occur during the breeding season. However, resource protection measures (measures Rx-4, Wildlife-2, Wildlife-4, Wildlife-9, Wildlife-10) during implementation would identify nest trees to mitigate loss and protect and retain the largest trees in stands during treatments. In the long term, burning treatments would increase habitat for gray vireo through development of larger trees, snags, open canopies, and other old-growth components in pinyon-juniper vegetation habitats. Prescribed burning will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire, and prescribed fire will directly create and increase snag habitat that this species utilizes for nesting. Providing adequate habitat would in turn support increasing opportunities for gray vireo populations in the project area. Fire also often creates fire scars and cavities in trees to replace the ones burned down. Considering that the gray vireo population on the Lincoln National Forest is minimal, the proposed action would improve habitat conditions and increase potential opportunities for gray vireo to move into the project area.

Any direct impacts from treatments may affect individual gray vireo but are not likely to impact the forest-wide population or habitat trends. Impacts would be short term, and gray vireo could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. In the long term, the burning treatments would improve the health and resiliency of pinyon-juniper woodland habitats, thereby maintaining or increasing suitable habitat for gray vireo. Indirect impacts to gray vireo, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact gray vireo in the form of ground-disturbing activities occurring during project implementation. If treatments within the project area occur during and after the breeding season, nesting behavior and success may be reduced during the initial implementation. However, resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within gray vireo habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact gray vireo. Indirect impacts to gray vireo from food source concerns in treated areas are not expected to have a measurable effect on the gray vireo because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to gray vireo, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of gray vireo habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on gray vireo are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of gray vireo may occur. Any indirect impacts to gray vireo from special use authorizations would be short term, and gray vireo could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to gray vireo is anticipated as these activities would not be long term in nature. Indirect impacts to gray vireo, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace gray vireo in the short term. However, gray vireo would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to gray vireo would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Determination of Effects

Under the proposed action, treatments and the associated resource protection measures will improve habitat and increase forest-wide populations of gray vireo. Impacts from the proposed action for gray vireo on the Lincoln National Forest will be localized, not landscape-wide, and over a period of time and populations are expected trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly. Some gray vireo habitat components such as pinyon-juniper woodlands and snags would be reduced in the short term. However, a multistory condition would be promoted, and trees of various size classes would be more equally distributed throughout the project area. Treatments would retain structural diversity by creating a mosaic of dense small groups of the various size classes of trees, inter-mixed with more openly spaced trees. This heterogeneous structure will provide greater habitat variability and structural components for nesting and foraging habitat for the gray vireo. The proposed action will also improve the overall health and resiliency of residual stands to insect, disease, and other disturbances in the long term.

The proposed vegetation treatments have been designed to retain and promote future development of suitable gray vireo habitat. Resource protection measures would be implemented to avoid and reduce impacts to the gray vireo and its habitat. This project **may impact individuals, but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for gray vireo on the Lincoln National Forest are considered short term and populations are expected to trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

Bald eagle (Haliaeetus leucocephalus)

Alternative 1 – No Action

Under this alternative, there would be no impact to bald eagles or their habitat from the proposed project because proposed activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. There would be no bald eagle habitat disturbance that could otherwise result under action alternatives from reopening closed roads, mechanical thinning, prescribed burning, and increased vehicle use. There would be no reduction in canopy cover in the vegetation structural stage 4 to 6 stands or groups, except where tree mortality continues to cause a loss of the larger trees and increasing the probability of landscape-wide, high-intensity wildfires. The current conditions and trends would continue to have some detrimental consequences to bald eagles nesting and roosting habitat as well as foraging habitat. There would continue to be fewer large trees as they would continue to be growth suppressed and die out prematurely due to the severe competition for moisture, light, and nutrients. The absence of fire allows the buildup of both surface fuels and seedlings and those seedlings begin to dominate the landscape as large trees die and are not replaced. Prescribed fire reduces those surface fuels and seedlings which helps recruitment into the larger vegetation structural stage classes. Without prescribed fire, the resilience and sustainability of these fire-adapted ecosystems would continue to decline. There would continue to be a lack of vegetation structural stage-1 grass, forb, and shrub habitat components. Historic meadows and shrublands would continue to be encroached by conifer trees. In addition, white fir would continue to dominate mixed conifer rather than the fire-resistant pine and Douglas-fir trees. As a consequence of all these conditions and trends, the area would remain very susceptible to a large high- intensity wildfire and loss of suitable bald eagle habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on bald eagles in the form of habitat disturbance during project implementation. Approximately 42,800 acres of representative bald eagle habitat would be treated by vegetation thinning and 80,200 acres would be treated using prescribed fire, which is aproximately 13 percent and 25 percent of representative bald eagle habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

Mechanical thinning may remove some nest sites and the direct effects associated with this treatment on habitat will be short term due to the resource protection measures (measures Water-1, Water-2, Water-4, Wildlife-3, Wildlife-4, Wildlife-7 through Wildlife-10) associated with the proposed action (e.g., retaining snags). Direct impacts from the proposed action may displace individuals during treatment operations if nest trees were cut down during the migrating or wintering season. Resource protection measures (measures Water-1, Water-2, Water-4, Wildlife-3, Wildlife-4, Wildlife-7 through Wildlife-10) would limit this potential effect by emphasizing the retention of the largest tree(s) and snags possible to meet the forest plan direction of three snags greater than 13 inches DBH per acre.

In addition, the required number of snags that this species needs will be retained by implementing northern goshawk and Mexican spotted owl resource protection measures (measures Wildlife-11, Wildlife-14). This project does not target the removal of snags but proposes the recruitment and retention of snags. The proposed action will improve this habitat by moving the ponderosa pine stands toward a more mature seral stage. The retention of snags and large trees would allow adequate foraging habitat during and after project implementation.

Ground-disturbing activities occurring during the winter season may disturb some nesting and foraging success during and after the initial implementation within the project area. If any treatments occur during the migratory and winter season, foraging behavior may be altered. The mechanical thinning will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire. Resource protection measures (measures Water-1, Water-2, Water-4, Wildlife-3, Wildlife-4, Wildlife-7 through Wildlife-10) such as retaining snags will retain future foraging and nesting sites for this species. Therefore, the population trend is expected to be stable. Given that important habitat features would be protected and that overall habitat conditions would improve in the long term, it is expected that the population trend for the bald eagle on the Lincoln National forest would remain stable under the proposed action.

Effects from the Use of Fire

Suitable habitat for this species would be maintained and increased by prescribed burning and wildland fire use, which would create random disturbance over the landscape and increase snags. Mature and old-growth mixed conifer forests that provide desirable habitat for the bald eagle would be maintained. Prescribed burns and managed wildfires will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire. The prescribed fire will directly create and increase snag habitat that this species utilizes for nesting and perching. The required number of snags that this species needs will be retained by implementing northern goshawk and Mexican spotted owl resource protection measures (measures Wildlife-11, Wildlife-14). This project does not target the removal of snags but proposes the recruitment and retention of snags. It will also improve the habitat for this species by uneven-aged management through fire.

Direct impacts from prescribed burns and managed wildfires may remove some foraging sites. However, the direct effects associated with this treatment on habitat will be short term due to the resource protection measures (measures Rx-4, Wildlife-3, Wildlife-4, Wildlife-7 through Wildlife-10) associated with the proposed action (e.g., retaining snags, burning parameters). Prescribed burning may temporarily displace individuals during treatment operations if large leafless trees and/or large trees with snags were burned down during the winter season. Resource protection measures (measures Rx-4, Wildlife-3, Wildlife-4, Wildlife-7 through Wildlife-10) would limit this potential effect by emphasizing the retention of the largest tree(s) and snags possible to meet the Forest Plan direction of three snags greater than 13 inches DBH per acre. This project does not target the removal of snags but proposes the recruitment and retention of snags. The retention of large trees and snags would allow adequate nesting and foraging habitat during and after project implementation.

Indirect effects, such as ground-disturbing activities may reduce some nesting and foraging success during and after the initial implementation within the project area. Foraging and nesting activities will increase within the project area after the initial implementation of disturbance. The burning associated with the proposed action will serve as a recruitment tool for snags within the project area and offset any loss of snags during implementation. Snag recruitment will also create opportunities for this species to perch and forage. It is expected that increased foraging and nesting activities will occur after prescribed burning. Given that important habitat features would be protected and that overall habitat conditions would improve in the long term, it is expected that the population trend for the bald eagle on the Lincoln National forest would remain stable under the proposed action.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact the bald eagle in the form of ground-disturbing activities occurring during project implementation. If treatments within the project area occur during and after the winter season, nesting behavior and foraging success may be reduced during the initial implementation. Foraging and nesting activities will increase within the project area after the initial implementation of disturbance. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within bald eagle winter habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact bald eagle. Indirect impacts to bald eagles from consuming live prey or carrion in treated areas should not affect bald eagles and are not expected to have a measurable effect on the bald eagle population. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve foraging conditions for the species. Indirect impacts to bald eagles, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15 through Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of bald eagle habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on bald eagles are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of bald eagles may occur. Any indirect impacts to bald eagles from special use authorizations would be short term, and bald eagles could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to bald eagles is anticipated as these activities would not be long term in nature. Indirect impacts to bald eagles, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace bald eagles in the short term. However, bald eagles would be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to bald eagles would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Determination of Effects

Given that important habitat features would be protected and that overall habitat conditions would be improved in the long term, it is expected that the population trend for the bald eagle on the Lincoln National Forest would remain stable under the proposed action. Additionally, the proposed vegetation treatments have been designed to retain and promote future development of suitable habitat. Resource protection measures would be implemented to minimize impacts to the bald eagles. This project **may impact individuals, but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for bald eagles on the Lincoln National Forest are considered short term, and populations are expected to remain stable, if not trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

Pale Townsend's big-eared bat (Corynorhinus townsendii pallescens)

Alternative 1 – No Action

Under this alternative, there would be no impact to pale Townsend's big-eared bat or their habitat from the proposed project because the proposed activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. The no action alternative does continue a management practice that produces vegetation trends associated with the lack of large, low-intensity surface fires. The lack of natural and prescribed fires would continue to degrade habitat quality within the fire-adapted woodland habitat. There would be continued declines in large trees due to growth suppression and insect and disease outbreaks under the current even-aged stand structure of the forest. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. The no action alternative would not disturb any roosting sites or remove habitat in the short term. The current conditions and forest health trends would continue to have some detrimental consequences to pale Townsend's big-eared bat habitat as well as roosting and foraging habitat. There would continue to be fewer large trees as they would continue to be growth suppressed and die out prematurely due to the severe competition for moisture, light, and nutrients. The absence of fire allows the buildup of both surface fuels and seedlings and those seedlings begin to dominate the landscape as large trees die and are not replaced. As a consequence of all these conditions and trends, the area would remain very susceptible to an uncharacteristic, high-intensity wildfire and potential loss of suitable pale Townsend's big-eared bat habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action would result in short-term adverse effects on the pale Townsend's big-eared bat in the form of habitat disturbance during project implementation. Approximately 42,800 acres of representative pale Townsend's big-eared bat habitat would be treated by vegetation thinning and 80,200 acres would be treated using prescribed fire, which is approximately 13 percent and 25 percent of representative pale Townsend's big-eared bat habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, the species habitat would improve and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to pale Townsend's big-eared bats roosting through disturbance from project activities, including equipment noise and vibration, smoke, and felling of trees. These impacts would be short term and pale Townsend's big-eared bat could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. Indirect impacts through loss of roosting and foraging habitat may affect the species from changes in vegetation structure, considering the species prefers mixed conifer, ponderosa pine forest, and pinyon-juniper woodland habitats. These impacts would be localized and short term, resulting from crews and equipment during project implementation. The loss of vegetation structure would also include the removal of some large trees or snags and could have an impact on the pale Townsend's big-eared bat. Vegetation removal may affect small quantities of insect prey used by this species, but the quantity involved is anticipated to be a small effect on the species. In general, project activities are expected to have a small effect on pale Townsend's big-eared bat foraging activity since these bats are nocturnal and project activities would take place during the day. To mitigate impacts in the project area, implementation of resource protection measures (Water-1, Water-2, Wildlife-1 through Wildlife-5, Wildlife-7 through Wildlife-10) will be incorporated to retain snags and logs and additional trees showing signs of mortality may be left for future snag and downed log recruitment. In addition, implementing northern goshawk and Mexican spotted owl resource protection measures for snags will also benefit this species (measures Wildlife-11, Wildlife-14). Thinning of overly dense stands and creation of open areas and edge habitat will result in a beneficial impact to foraging habitat (Humes and others 1999).

Effects from the Use of Fire

Direct impacts from prescribed fire treatments could burn up mixed conifer, ponderosa pine forest, and pinyon-juniper woodland habitats used for foraging and may displace individuals during treatment operations for a short period. The loss of vegetation structure would also include the removal of large trees or snags and could have an impact to the pale Townsend's big-eared bat. Prescribed burns may affect small quantities of insect prey used by this species, but the quantity involved is anticipated to be minor for the species. Additionally, smoke from prescribed burns within 0.25 to 0.50 mile of hibernacula will adversely affect bat species. Prescribed burning within 200 yards of a hibernacula cave can also increase temperatures in the cave. Resource protection measures (Rx-4, Wildlife-1) call for a buffer to be in place during project activities. No direct ignition of prescribed fire would occur within a cave buffer. Buffer size will be determined on a site-specific basis and site-specific conditions to protect cave ecosystems and limit disturbance to roosting bats. Short-term impacts to pale Townsend's big-eared bat may occur if treatment operations occur near roosting sites. However, pale Townsend's big-eared bat could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area.

Indirect impacts to pale Townsend's big-eared bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation. However, project activities may affect pale Townsend's big-eared bat foraging activity since these bats are nocturnal and project activities would take place during the day. In the long term, the prescribed burn treatments would improve the health and resiliency of habitats used by the species, thereby maintaining or increasing suitable habitat for the pale Townsend's big-eared bat. Providing adequate habitat would in turn support the pale Townsend's big-eared bat population trends. Any direct impacts from treatments may affect individual pale Townsend's big-eared bat but are not likely to impact the forest-wide population or habitat trends.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact pale Townsend's big-eared bat in the form of ground-disturbing activities occurring during project implementation. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) for herbicide mixing areas and herbicide use during implementation would minimize potential disturbance concerns within pale Townsend's big-eared bat habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact pale Townsend's big-eared bat. Indirect impacts to pale Townsend's big-eared bat from consuming insects in treated areas are expected to have a small effect on the pale Townsend's big-eared bat because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to pale Townsend's big-eared bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-1, Wildlife-5, Wildlife-11), which call for a buffer to be in place during project activities. Buffer size will be determined on a site-specific basis and site-specific conditions. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of pale Townsend's big-eared bat habitat to the adverse effects of drought. Other activities, such as recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially impacting suitable habitat for drinking water by causing trampling, soil compaction, and introductions of nonnative plant species. Incorporating plans for water drinkers that are bat-friendly, such as long and narrow drinkers mimicking streams, can minimize impacts and be beneficial.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on pale Townsend's big-eared bat are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) and siting criteria described in the proposed action would be in place. However, indirect impacts such as displacement of pale Townsend's big-eared bat may occur. Any indirect impacts to pale Townsend's big-eared bat from special use authorizations would be short term, and pale Townsend's big-eared bat could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to pale Townsend's big-eared bat is anticipated as these activities would not be long term in nature. Indirect impacts to pale Townsend's big-eared bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation will be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace pale Townsend's big-eared bat in the short term. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. However, pale Townsend's big-eared bat may be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to pale Townsend's big-eared bat would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Determination of Effects

Given that important habitat features would be protected and that overall habitat conditions would be improved in the long term, it is expected that the population trend for the pale Townsend's big-eared bat on the Lincoln National Forest would remain stable under the proposed action. Additionally, the proposed vegetation treatments have been designed to retain and promote future development of suitable habitat. Resource protection measures as described above would be implemented to minimize impacts to the pale Townsend's big-eared bat. This project **may impact individuals but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for pale Townsend's big-eared bat on the Lincoln National Forest are considered short term, and populations are expected to remain stable, if not trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

Spotted bat (Euderma maculatum)

Alternative 1 – No Action

Under this alternative, there would be no impact to the spotted bat or their habitat from the proposed project because the proposed activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. The no action alternative does continue a management practice that produces vegetation trends associated with the lack of large, low-intensity surface fires. The lack of natural ground fire would continue to degrade habitat quality within the fire-adapted woodland habitat. There would be continued declines in large trees due to growth suppression and insect and disease outbreaks under the current even-aged stand structure of the forest. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. The no action alternative would not disturb any roosting sites or remove habitat in the short term. The current conditions and forest health trends would continue to have some detrimental consequences to the spotted bat habitat as well as roosting and foraging habitat. There would continue to be fewer large trees as they would continue to be growth suppressed and die out prematurely due to the severe competition for moisture, light, and nutrients. The absence of fire allows the buildup of both surface fuels and seedlings and those seedlings begin to dominate the landscape as large trees die and are not replaced. As a consequence of all these conditions and trends, the area would remain very susceptible to an uncharacteristic, high-intensity wildfire and potential loss of suitable spotted bat habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on the spotted bat in the form of habitat disturbance during project implementation. Approximately 42,800 acres of representative spotted bat habitat would be treated by vegetation thinning and 80,200 acres would be treated using prescribed fire, which is approximately 13 percent and 25 percent of representative spotted bat habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be mitigated through the application of the resource protection measures. The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, the species habitat would improve and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to spotted bats roosting through disturbance from project activities, including equipment noise and vibration, smoke, and felling of trees. These impacts would be short term and spotted bats could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. Indirect impacts through loss of roosting and foraging habitat may affect the species from changes in vegetation structure, considering the species prefers mixed conifer, ponderosa pine forest, and pinyon-juniper woodland habitats. These impacts would be localized and short term, resulting from crews and equipment during project implementation. The loss of vegetation structure would also include the removal of some large trees or snags and could have an impact to the spotted bat. Vegetation removal may affect small quantities of insect prey used by this species, but the quantity involved is anticipated to have a small effect on the species. In general, project activities are not expected to have a small effect on spotted bat foraging activity since these bats are nocturnal and project activities would take place during the day. To mitigate impacts in the project area, implementation of resource protection measures (measures Water-1, Water-2, Wildlife-1 through Wildlife-5, Wildlife-7 through Wildlife-10) will be incorporated to retain snags and logs and additional trees showing signs of mortality may be left for future snag and downed log recruitment. In addition, implementing northern goshawk and Mexican spotted owl resource protection measures for snags will also benefit this species (measures Wildlife-11, Wildlife-14). However, impacts to the species may also occur in treatment areas within Mexican spotted owl protected activity centers where Mexican spotted owl resource protection measures (measures Wildlife-11) may be bypassed. Thinning of overly dense stands and creation of open areas and edge habitat will result in a beneficial impact to foraging habitat (Humes and others 1999).

Effects from the Use of Fire

Direct impacts from prescribed fire treatments could burn up mixed conifer, ponderosa pine forest, and pinyon-juniper woodland habitats used for foraging and may displace individuals during treatment operations for a short period. The loss of vegetation structure would also include the removal of large trees or snags and could have an impact to the spotted bat. Prescribed burns may affect small quantities of insect prey used by this species, but the quantity involved is anticipated to have a small effect on the species. Additionally, smoke from prescribed burns within 0.25 to 0.50 mile of hibernacula will adversely affect bat species. Prescribed burning within 200 yards of a hibernacula cave can also increase temperatures in the cave. Resource protection measures (measures Rx-4, Wildlife-1) are in place to set buffers for treatments around cave entrances to reduce potential disturbance to roosting bats and avoid direct ignition of fire within buffers. Short-term impacts to spotted bat may occur if treatment operations occur near roosting sites and spotted bat could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area.

Indirect impacts to spotted bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation. However, project activities are not expected to have a measurable effect on spotted bat foraging activity since these bats are nocturnal and project activities would take place during the day. In the long term, the prescribed burn treatments would improve the health and resiliency of habitats used by the species, thereby maintaining or increasing suitable habitat for the spotted bat. Providing adequate habitat would in turn support the spotted bat population trends. Any direct impacts from treatments may affect individual spotted bats but are not likely to impact the forest-wide population or habitat trends.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact spotted bat in the form of ground-disturbing activities occurring during project implementation. Resource protection measures (Public-3, Herbicide-1 through Herbicide-6) for herbicide mixing areas and herbicide use during implementation would minimize potential disturbance concerns within spotted bat habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact spotted bat. Indirect impacts to spotted bat from consuming insects in treated areas are expected to have a small effect on the spotted bat because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to spotted bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15 through Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-1, Wildlife-5, Wildlife-11), such as avoidance and buffering to protect cave ecosystems, are in place to protect all wildlife. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of spotted bat habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially impacting suitable habitat by causing trampling, soil compaction, and introductions of nonnative plant species. Incorporating plans for water drinkers that are bat-friendly, such as long and narrow drinkers mimicking streams, can minimize impacts and be beneficial.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on spotted bat are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of spotted bat may occur. Any indirect impacts to spotted bat from special use authorizations would be short term, and spotted bat could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to spotted bat is anticipated as these activities would not be long term in nature. Indirect impacts to spotted bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace spotted bat in the short term. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. However, spotted bat may be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to spotted bat would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Determination of Effects

Given that important habitat features would be protected and that overall habitat conditions would be improved in the long term, it is expected that the population trend for the spotted bat on the Lincoln National Forest would remain stable under the proposed action. Additionally, the proposed vegetation treatments have been designed to retain and promote future development of suitable habitat. Resource protection measures would be implemented to minimize impacts to the spotted bat (see Chapter 2, Section 2.2.5). This project **may impact individuals, but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for spotted bat on the Lincoln National Forest are considered short term, and populations are expected to remain stable, if not trend upward as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

Western red bat (Lasiurus blossevillii)

Alternative 1 – No Action

Under this alternative, there would be no impact to western red bat or their habitat from the proposed project because the proposed activities would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. The no action alternative does continue a management practice that produces vegetation trends associated with the lack of large, low-intensity surface fires. The lack of natural ground fire would continue to degrade habitat quality within the fire-adapted woodland habitat. There would be continued declines in large trees due to growth suppression and insect and disease outbreaks under the current even-aged stand structure of the forest. There would be no noise or visual disturbance from proposed activities or any reduction in habitat components. The no action alternative would not disturb any roosting sites or remove habitat in the short term. The current conditions and forest health trends would continue to have some detrimental consequences to western red bat habitat as well as roosting and foraging habitat. There would continue to be fewer large trees as they would continue to be growth suppressed and die out prematurely due to the severe competition for moisture, light, and nutrients. The absence of fire allows the buildup of both surface fuels and seedlings and those seedlings begin to dominate the landscape as large trees die and are not replaced. As a consequence of all these conditions and trends, the area would remain very susceptible to an uncharacteristic, high-intensity wildfire and potential loss of suitable western red bat habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action would result in short-term adverse effects on the western red bat in the form of habitat disturbance during project implementation. Approximately 42,800 acres of representative western red bat habitat would be treated by vegetation thinning and 80,200 acres would be treated using prescribed fire, which is approximately 13 percent and 25 percent of representative western red bat habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, these potential adverse effects would be mitigated through the application of the resource protection measures (see Chapter 2, Section 2.2.5). The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, the species habitat would improve and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to western red bats roosting through disturbance from project activities, including equipment noise and vibration, smoke, and felling of trees. These impacts would be short term and western red bats could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area. Indirect impacts through loss of roosting and foraging habitat may affect the species from changes in vegetation structure, considering the species prefers mixed conifer, ponderosa pine forest, and pinyon-juniper woodland habitats. These impacts would be localized and short term, resulting from crews and equipment during project implementation. The loss of vegetation structure would also include the removal of some large trees or snags and could have an impact to the western red bat. Vegetation removal may affect small quantities of insect prey used by this species, but the quantity involved is anticipated to have a small effect on the species. In general, project activities are expected to have a small effect on western red bat foraging activity since these bats are nocturnal and project activities would take place during the day. To mitigate impacts in the project area, implementation of resource protection measures (measures Water-1, Water-2, Wildlife-1 through Wildlife-5, Wildlife-7 through

Wildlife-10) will be incorporated to retain snags and logs and additional trees showing signs of mortality may be left for future snag and downed log recruitment. In addition, implementing northern goshawk and Mexican spotted owl resource protection measures for snags will also benefit this species (measures Wildlife-11, Wildlife-14). However, impacts to the species may also occur in treatment areas within Mexican spotted owl protected activity centers where Mexican spotted owl resource protection measures (measures Wildlife-11) may be bypassed. Thinning of overly dense stands and creation of open areas and edge habitat will result in a beneficial impact to foraging habitat (Humes and others 1999).

Effects from the Use of Fire

Direct impacts from prescribed fire treatments could burn up mixed conifer, ponderosa pine forest, and pinyon-juniper woodland habitats used for foraging and may displace individuals during treatment operations for a short period. The loss of vegetation structure would also include the removal of large trees or snags and could have an impact to the western red bat. Prescribed burns may affect small quantities of insect prey used by this species, but the quantity involved is anticipated to have a small effect on the species. Additionally, smoke from prescribed burns within 0.25 to 0.50 mile of hibernacula will adversely affect bat species. Prescribed burning within 200 yards of a hibernacula cave can also increase temperatures in the cave. Resource protection measures (measures Rx-4, Wildlife-1) are in place to set buffers for treatments around cave entrances to reduce potential disturbance to roosting bats and avoid direct ignition of fire within buffers. Short-term impacts to western red bat may occur if treatment operations occur near roosting sites and western red bat could move to other parts of the Lincoln National Forest when site-specific treatments occur in the project area.

Indirect impacts to western red bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation. In general, project activities are expected to have a small effect on western red bat foraging activity since these bats are nocturnal and project activities would take place during the day. In the long term, the prescribed burn treatments would improve the health and resiliency of habitats used by the species, thereby maintaining or increasing suitable habitat for the western red bat. Providing adequate habitat would in turn support the western red bat population trends. Any direct impacts from treatments may affect individual western red bats but are not likely to impact the forest-wide population or habitat trends.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact western red bat in the form of ground-disturbing activities occurring during project implementation. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) for herbicide mixing areas and herbicide use during implementation would minimize potential disturbance concerns within western red bat habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact western red bat. Indirect impacts to western red bat from consuming insects in treated areas are expected to have a small effect on western red bat because herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to western red bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15, Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-1, Wildlife-5, Wildlife-11), such as avoidance and buffering to protect cave ecosystems, are in place to protect all wildlife. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of western red bat habitat to the adverse effects of drought. Other activities, such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially impacting suitable habitat by causing trampling, soil compaction, and introductions of nonnative plant species. Incorporating plans for water drinkers that are bat-friendly, such as long and narrow drinkers mimicking streams, can minimize impacts and be beneficial.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on western red bat are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of western red bat may occur. Any indirect impacts to western red bat from special use authorizations would be short term, and western red bat could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to western red bat is anticipated as these activities would not be long term in nature. Indirect impacts to western red bat, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace western red bat in the short term.

For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. However, western red bat may be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to western red bat would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Determination of Effects

Given that important habitat features would be protected and that overall habitat conditions would be improved in the long term, it is expected that the population trend for the western red bat on the Lincoln National Forest would remain stable under the proposed action. Additionally, the proposed vegetation treatments have been designed to retain and promote future development of suitable habitat. Resource protection measures would be implemented to minimize impacts to the western red bat (see Chapter 2, Section 2.2.5). This project **may impact individuals but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for western red bat on the Lincoln National Forest are considered short term, and populations are expected to remain stable as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

New Mexico shrew (Sorex neomexicanus)

Alternative 1 – No Action

Under this alternative, there would be no project-related impacts to the New Mexico shrew or their habitat in the area because the project would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. Under the no action alternative, New Mexico shrew habitat would continue to be at a high risk of uncharacteristic fire events and insect and disease outbreaks under the current even-aged stand structure of the forest. Stand density-related mortality in the larger trees would continue to increase. This would have negative and positive effects on New Mexico shrew habitat. The loss of large tree canopy cover would be a loss of that habitat feature, although the New Mexico shrew would benefit by the increase in numbers of large, downed logs. Because this alternative proposes no action, direct and indirect impacts to the New Mexico shrew and habitat would continue to occur through intensive logging, slash removal, and burning which may reduce or eliminate populations of the New Mexico shrew. The no action alternative does not propose necessary treatments needed for sustaining or enhancing New Mexico shrew habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on the New Mexico shrew in the form of habitat disturbance during project implementation. Proposed activities may retain the key habitat requirements for the New Mexico shrew as much as possible to maintain habitat suitability. Approximately 42,800 acres of representative New Mexico shrew habitat would be treated by vegetation thinning and 80,200 acres would be treated using prescribed fire, which is approximately 13 percent and 25 percent of representative New Mexico shrew habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, some treatment activities may occur when the ground surface and soils are wet. During these periods, potential adverse effects would be mitigated through the application of the resource protection measures described in the text below as New Mexico shrew may be under ground cover (see Appendix C in the Biological Evaluation). The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, habitat for the species would improve, and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to the New Mexico shrew and indirect impacts through loss of habitat, considering the species prefers mesic habitats where there is moist vegetation. The thinning treatments involve free thinning of all tree sizes,

thin from below, and group selection with matrix thinning between groups. Thinning treatments would remove the smallest trees in the understory and fewer of the live overstory canopy. The result would be a reduction in tree density, but minimal change to the canopy cover helping maintain shading of the forest floor. Openings would be a maximum of 200 feet wide. Direct impacts of these treatments would reduce the amount of shade and stand density and would affect the microhabitat (e.g., temperature and humidity) of New Mexico shrew habitat. Additionally, the more open understory and overstory gaps in the tree canopy would impact habitat by reducing the moisture and increasing temperatures on the forest floor, which would slightly reduce quality of the habitat. New Mexico shrews would be expected to avoid the warmer, drier openings created on the ground as a result of thinning. However, resource protection measures (measures Water-1, Water-2, Water-4, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8) and timing restrictions are in place to protect Mexican spotted owl and Sacramento Mountains salamander on these sites by retaining dense clumps of trees and relatively higher overstory canopy cover to provide adequate shading on the forest floor. These resource protection measures (measures Wildlife-11, Wildlife-15) will additionally protect the New Mexico shrew. However, impacts to the species may also occur in treatment areas within Mexican spotted owl protected activity centers where Mexican spotted owl resource protection measures (measure Wildlife-11) may be bypassed.
The retention of downed woody material maintains is an important habitat component for this species. The potential disturbance of ground cover and moist humus for New Mexico shrews by the use of heavy equipment may cause a decrease in species numbers in a particular area. The chipping or mastication within occupied habitat may alter fauna within the area, which may impact the insect prey species of the New Mexico shrew.

Treatment activities will benefit the New Mexico shrew by increasing the amount of woody debris on the forest floor to improve soil moisture and microhabitat quality. The overall changes in humidity, soil moisture, and temperature would be minimal and not substantially impact potential suitability of the habitat. Within a year following thinning treatments, there would be a substantial increase in the abundance of grasses and forbs, especially in the small canopy gaps. Increases in grasses and forbs in the understory would increase substrate for insect prey species of the New Mexico shrew. Downed logs and wood are key habitat features and thinning would not remove existing downed logs, but would generate additional downed logs and woody material (tree stems and branches). There would be sufficient downed logs and woody material to maintain or enhance New Mexico shrew habitat and insect food sources in this area. Snags are considered future replacement downed logs, as they eventually fall to the ground. Resource protection measures (measures Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8) are also built into the project and address the need to retain large trees and snags to provide wildlife habitat. The snags retained within the project area, combined with the snags in adjacent untreated forest stands, would likely result in continuation of snag abundance within suitable and occupied New Mexico shrew habitat. Thus, large logs and downed wood should continue to remain abundant in the future as snags fall to the ground over time.

Effects from the Use of Fire

The restoration methods and associated activities of the project could have a direct impact to New Mexico shrew and indirect impacts through loss of habitat, considering the species prefers habitats with forest canopies and ground surface cover. All prescribed burn treatment areas within New Mexico shrew habitat would only be low-intensity surface burns. Direct impacts of prescribed burning would temporarily reduce the soil moisture available for the New Mexico shrew and its prey species for the first year. Prescribed burning will consume some of the existing downed woody material. The mosaic pattern of the burn will also open some of the canopy within occupied habitat. The burning prescriptions will primarily focus on removing small-diameter trees, occasionally removing larger size classes. Prescribed fire will lead to downed woody material recruitment that the New Mexico shrew will utilize and will also offset any potential loss of existing downed woody material. The prescribed fire will lead to greater fauna diversity that its prey will utilize as well. This will in return improve the foraging habitat of the New Mexico shrew. Retaining the larger trees will help maintain cool moist microclimates and help create habitat conditions that this species needs. Grasses and forbs would rapidly grow in and replenish the soil moisture, along with the additional downed wood left from thinning. Within 5 years, there would additionally be new tree seedlings and more mature plants on the forest floor, substantially improving the microclimate and forest floor habitat conditions for the New Mexico shrew. The fire-charring of downed logs from prescribed burns may harden parts of the logs and reduce their rate of deterioration. This may slightly reduce potential abundance of insects and other invertebrate prey species (Pilliod and others 2006).

Indirect effects may occur in the form of habitat loss from the use of heavy equipment causing disturbance to moist ground cover areas for New Mexico shrews, which may cause a decrease in species numbers in a particular area. Resource protection measures (measures Rx-4, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8) and timing restrictions are in place to protect Mexican spotted owl and Sacramento Mountains salamander on these sites by retaining dense clumps of trees and relatively higher overstory canopy cover to provide adequate shading on the forest floor. Excluding treatments occurring within Mexican spotted owl protected activity centers, where Mexican spotted owl resource protection measures (measure Wildlife-11) may be bypassed, may impact individuals of the species. Habitats with dense mixed conifer and aspen forests within the elevational range of the species would be maintained within the existing stands as well as ground surface cover such as rocks, logs, and organic material. Based on the overall benefits of the proposed action, i.e., reducing the potential for uncharacteristic high-severity fires and improving forest health, habitat for the New Mexico shrew is assumed to be improved and/or restored.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact the New Mexico shrew in the form of ground-disturbing activities occurring during project implementation. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within New Mexico shrew habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact New Mexico shrew. Indirect impacts to New Mexico shrew from consuming insects in treated areas may affect New Mexico shrew, but herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to the New Mexico shrew, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15 through Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of New Mexico shrew habitat to the adverse effects of drought. Other activities such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on the New Mexico shrew are expected as resource protection measures are in place for wildlife could minimize impacts from forest industry activities (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx- 3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11). However, indirect impacts such as displacement of New Mexico shrew may occur. Any indirect impacts to New Mexico shrew from special use authorizations would be short term, and New Mexico shrew could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to New Mexico shrew is anticipated as these activities would not be long term in nature. Indirect impacts to New Mexico shrew, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace New Mexico shrew in the short term. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. However, New Mexico shrew may be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to New Mexico shrew would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site specific treatments are completed.

Determination of Effects

Given that important habitat features would be protected and that overall habitat conditions would be improved in the long term, it is expected that the population trend for the New Mexico shrew on the Lincoln National Forest would remain stable under the proposed action. Additionally, the proposed vegetation treatments have been designed to retain and promote future development of suitable habitat. Resource protection measures would be implemented to minimize impacts to the New Mexico shrew as described above. This project **may impact individuals but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for New Mexico shrew on the Lincoln National Forest are considered short term, and populations are expected to remain stable as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

Ruidoso snaggletooth snail (Gastrocopta ruidosensis)

Alternative 1 – No Action

Under this alternative, there would be no project-related impacts to the Ruidoso snaggletooth snail or its habitat in the area because the project would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. Under the no action alternative, Ruidoso snaggletooth snail habitat would continue to be at a high risk of uncharacteristic fire events and insect and disease outbreaks under the current even-aged stand structure of the forest. Stand density-related mortality in the larger trees would continue to increase. This would have negative and positive effects on Ruidoso snaggletooth snail habitat.

The current conditions and trends would continue to have some detrimental consequences to Ruidoso snaggletooth snail habitat. The absence of fire allows the buildup of both surface fuels and seedlings and those seedlings begin to dominate the landscape as large trees die and are not replaced. As a consequence of all these conditions and trends, the area would remain very susceptible to a large, high intensity wildfire and loss of suitable Ruidoso snaggletooth snail habitat. The no action alternative does not propose necessary treatments needed for sustaining or enhancing Ruidoso snaggletooth snail habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on the Ruidoso snaggletooth snail in the form of habitat disturbance during project implementation. Proposed activities would retain the key habitat requirements for the Ruidoso snaggletooth snail to maintain habitat suitability. Approximately 18,310 acres of representative Ruidoso snaggletooth snail habitat would be treated by vegetation thinning and 39,920 acres would be treated using prescribed fire, which is approximately 3 percent and 6 percent of representative Ruidoso snaggletooth snail habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, some treatment activities may occur and disturb the ground surface, grasses, and litter. Potential adverse effects would be mitigated through the application of the resource protection measures as Ruidoso snaggletooth snail may be under ground cover (see Chapter 2, Section 2.2.5). The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, the species habitat would improve, and individuals could expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to the Ruidoso snaggletooth snail and indirect impacts through loss of habitat, considering the species prefers ponderosa pine and scrub mahogany/Gambel oak forest habitats. The thinning treatments involve free thinning of all tree sizes, thin from below, and group selection with matrix thinning between groups. Thinning from below would remove the smallest trees in the understory and fewer of the live overstory canopy. The result would be a reduction in tree density, canopy cover, and shading of the forest floor. Openings would be a maximum of 200 feet wide. Direct impacts of these treatments would disturb the ground surface, grasses, and litter in ponderosa pine habitats of the Ruidoso snaggletooth snail and may affect a few individuals of this species. The potential disturbance of ground cover for Ruidoso snaggletooth snails by the use of heavy equipment may cause a decrease in species numbers in a particular area. The chipping or mastication within habitat may impact suitable habitats of the Ruidoso snaggletooth snail. Indirect effects of project activities could come in the form of sedimentation from treatments at higher elevations. However, resource protection measures (measures Soil-1, Soil-3, Water-1, Water-2, Water-5, Water-7 and Water-8) are in place to prevent sedimentation at treatment sites. Following thinning treatments, there would be a substantial increase in the abundance of grasses and forbs, especially in the small canopy gaps. Increases in grasses and forbs in the understory would also increase habitat for Ruidoso snaggletooth snail.

Effects from the Use of Fire

The direct effects of the restoration methods and associated activities of the project could have a direct impact to the Ruidoso snaggletooth snail and indirect impacts through loss of habitat, considering the species prefers ponderosa pine forest habitats with ground surface litter. Burning activity may negatively impact the habitat of the species. However, where the species has been found (talus slopes, ledges, etc.), would likely not burn uniformly. All prescribed burn treatment areas within Ruidoso snaggletooth snail habitat would only be low-intensity surface burns. Direct impacts of prescribed burning would temporarily reduce surface litter available for the Ruidoso snaggletooth snail for the first year. Prescribed burning will consume some of the existing downed woody material. The mosaic pattern of the burn will also open some of the canopy within occupied habitat. The burning prescriptions will primarily focus on removing small-diameter trees, occasionally removing larger size classes. These treatments will increase habitat for the Ruidoso snaggletooth snail through development of larger trees, snags, open canopies, and other old-growth components in pinyon-juniper vegetation habitats. This will in return improve surface litter and grass habitat as grasses and forbs would rapidly grow in and replenish the soil moisture, along with the additional downed wood left from thinning. Prescribed burning will directly reduce the amount of fuels, which will reduce the risk of stand-replacing wildfire and prescribed fire will directly create and increase habitat for this species.

Indirect effects may occur in the form of habitat loss from the use of heavy equipment causing disturbance to ground cover areas for Ruidoso snaggletooth snails, which may cause a decrease in species numbers in a particular area. Resource protection measures (measures Rx-4, Soil-3, Wildlife-2, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8, Wildlife-9) are in place to retain dense clumps of trees and canopy cover to provide shading on the forest floor, which may also protect the Ruidoso snaggletooth snail by maintaining or increasing ground surface cover such as rocks, logs, and organic material. Based on the overall benefits of the proposed action, i.e., reducing the potential for uncharacteristic high-severity fires and improving forest health, habitat for the Ruidoso snaggletooth snail is assumed to be improved and/or restored. It is possible that the creation of diverse habitat features could result in the Ruidoso snaggletooth snail becoming reestablished or more prolific in the project area.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Direct impacts from herbicide treatments could impact the Ruidoso snaggletooth snail in the form of herbicide application to juniper shrubs as the species utilizes juniper litter within ponderosa pine forests and scrub mahogany/Gambel oak vegetation. Herbicide application would also decrease available habitat for the Ruidoso snaggletooth snail. Additional direct impacts may occur from ground-disturbing activities occurring during project implementation. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) for wildlife applied during implementation would minimize potential disturbance concerns within Ruidoso snaggletooth snail habitat. Indirect impacts to Ruidoso snaggletooth snail from consuming insects in treated areas may affect the Ruidoso snaggletooth snail, but herbicide treatments would not be extensive. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Similarly, herbicide treatments to oak and juniper sprouts would reduce the density of shrubs, which would improve habitat conditions. Indirect impacts to Ruidoso snaggletooth snail, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15 through Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Ruidoso snaggletooth snail habitat to the adverse effects of drought. Other activities such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on the Ruidoso snaggletooth snail are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of Ruidoso snaggletooth snail may occur. Any indirect impacts to Ruidoso snaggletooth snail from special use authorizations would be short term, and Ruidoso snaggletooth snail could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to Ruidoso snaggletooth snail is anticipated as these activities would not be long term in nature. Indirect impacts to Ruidoso snaggletooth snail, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation will be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace Ruidoso snaggletooth snail in the short term. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. However, Ruidoso snaggletooth snail may be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to Ruidoso snaggletooth snail would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Determination of Effects

Given that important habitat features would be protected and that overall habitat conditions would be improved in the long term, it is expected that the population trend for the Ruidoso snaggletooth snail on the Lincoln National Forest would remain stable under the proposed action. Additionally, the proposed vegetation treatments have been designed to retain and promote future development of suitable habitat. Resource protection measures would be implemented to minimize impacts to the Ruidoso snaggletooth snail as described above. This project **may impact individuals but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for Ruidoso snaggletooth snail on the Lincoln National Forest are considered short term, and populations are expected to remain stable as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained.

Sacramento Mountains checkerspot butterfly (Euphydryas anicia cloudcrofti)

Alternative 1 – No Action

Under this alternative, there would be no project-related impacts to the Sacramento Mountains checkerspot butterfly or their habitat in the area because the project would not be implemented. Current management plans would continue to guide existing and previously authorized activities in the project area. Under the no action alternative, Sacramento Mountains checkerspot butterfly habitat would continue to be at a high risk of uncharacteristic fire events and insect and disease outbreaks under the current even-aged stand structure of the forest. Stand density-related mortality in the larger trees would continue to increase. This would have negative and positive effects on Sacramento Mountains checkerspot butterfly habitat.

The current conditions and trends would continue to have some detrimental consequences to Sacramento Mountains checkerspot butterfly habitat. The absence of fire allows the buildup of both surface fuels and seedlings and those seedlings begin to dominate the landscape as large trees die and are not replaced. As a consequence of all these conditions and trends, the area would remain very susceptible to a large, high-intensity wildfire and loss of suitable Sacramento Mountains checkerspot butterfly habitat. The no action alternative does not propose necessary treatments needed for sustaining or enhancing Sacramento Mountains checkerspot butterfly habitat.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action could result in short-term adverse effects on the Sacramento Mountains checkerspot butterfly in the form of habitat disturbance during project implementation. Proposed activities would retain the key habitat requirements for the Sacramento Mountains checkerspot butterfly to maintain habitat suitability. Approximately 43,800 acres of representative Sacramento Mountains checkerspot butterfly habitat would be treated by vegetation thinning and 81,400 acres would be treated using prescribed fire, which is approximately 13 percent and 24 percent of representative Sacramento Mountains checkerspot butterfly habitat in the Lincoln National Forest for the vegetation thinning and prescribed fire restoration methods, respectively. However, some treatment activities may occur and disturb the ground surface, grasses, and litter. Potential adverse effects would be mitigated through the application of the resource protection measures described in the text below as Sacramento Mountains checkerspot butterfly may be on larval and adult food plants within mixed-conifer forests (see Chapter 2, Section 2.2.5). The proposed action would result in long-term beneficial effects on the species because the restoration treatments would reduce the risk of high-intensity wildfire as well as improve forest health conditions within the project area. By reducing the threat of wildfire and improving forest health, the species habitat would improve, and individuals would have the potential to expand into previously unoccupied areas.

Effects from Vegetation Thinning

The restoration methods and associated activities of the project could have a direct impact to the Sacramento Mountains checkerspot butterfly and indirect impacts through loss of habitat, considering the species prefers mixed-conifer forest habitats. The thinning treatments involve free thinning of all tree sizes, thin from below, and group selection with matrix thinning between groups. Thinning from below would remove the smallest trees in the understory and fewer of the live overstory canopy. The result would be a reduction in tree density, canopy cover, and shading of the forest floor. Openings would be a maximum of 200 feet wide. Direct impacts of these treatments would disturb the ground surfaces and food sources in mixed-conifer forest habitats and may affect a few individuals of this species. The potential disturbance of adult and larval food sources for Sacramento Mountains checkerspot butterfly by the use of heavy equipment may cause a decrease in species numbers in a particular area. The chipping or mastication within habitat may also impact suitable habitats of the Sacramento Mountains checkerspot butterfly. However, project activities are not expected to have a measurable effect to the Sacramento Mountains checkerspot butterfly since the project activities are limited in scope within meadow habitats in the project area.

Indirect effects of project activities could come in the form of disturbance from treatment activities. Vegetation treatments activities associated with the proposed action may temporarily displace Sacramento Mountains checkerspot butterfly in the short term. Short-term minor adverse effects would include increased sedimentation from treatments on steep slopes and modification of habitat by shifting the vegetation density of some areas from more dense to less dense vegetative cover. However, human disturbance to Sacramento Mountains checkerspot butterfly would be localized and short term, resulting from crews and equipment during project implementation. Project activities are not expected to have an impact to the Sacramento Mountains checkerspot butterfly as resource protection measures, such as avoidance and buffering, are in place to protect wildlife (measures Water-2, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8, Wildlife-16). Following thinning treatments, there would be a substantial increase in the abundance of grasses and forbs, especially in the canopy gaps. In the long term, these vegetation treatments would improve habitat conditions for the Sacramento Mountains checkerspot butterfly by creating openings and promoting adult and larval food sources.

Effects from the Use of Fire

The direct effects of the restoration methods and associated activities of the project could have a direct impact to the Sacramento Mountains checkerspot butterfly and indirect impacts through loss of habitat, considering the species prefers mixed-conifer forest habitats. Burning activity may negatively impact the habitat of the species. All prescribed burn treatment areas within Sacramento Mountains checkerspot butterfly habitat would only be low-intensity surface burns. Direct impacts of prescribed burning may temporarily reduce meadow habitat available for the Sacramento Mountains checkerspot butterfly for the first year. The mosaic pattern of the burn will also open some of the canopy within occupied habitat. The burning prescriptions will primarily focus on removing small-diameter trees, occasionally removing larger size classes. Prescribed fire will lead to downed woody material recruitment that will improve meadow habitat as grasses and forbs would rapidly grow in and replenish the soil moisture, along with the additional downed wood left from thinning. Within 5 years, there would additionally be new tree seedlings and more mature plants on the forest floor, substantially improving the microclimate and forest meadow habitat conditions for the Sacramento Mountains checkerspot butterfly.

Indirect effects may occur in the form of habitat loss from the use of heavy equipment causing disturbance to meadow habitats of the Sacramento Mountains checkerspot butterfly, which may cause a decrease in species numbers in a particular area. Short-term adverse effects would include increased sedimentation and ash flow from treatments on steep slopes and modification of habitat by shifting the vegetation density of some areas from more dense to less dense vegetative cover. Project activities may impact individual Sacramento Mountains checkerspot butterflies even with resource protection measures, such as avoidance and buffering, in place to protect wildlife (measures Rx-4, Soil-3, Wildlife-3, Wildlife-4, Wildlife-7, Wildlife-8, Wildlife-16). Based on the overall benefits of the proposed action, i.e., reducing the potential for high-severity fires, improving forest health, and diversifying habitat conditions across the project area, habitat for the Sacramento Mountains checkerspot butterfly is assumed to be improved and/or restored. It is possible that the creation of diverse habitat features could result in the Sacramento Mountains checkerspot butterfly's becoming reestablished or more prolific in the project area.

Effects from Targeted Herbicide Applications

Under the proposed action, herbicide treatments would be used to control juniper and oak sprouts, where feasible. Direct impacts from herbicide treatments could impact the Sacramento Mountains checkerspot butterfly in the form of ground-disturbing activities occurring during project implementation. Resource protection measures (measures Public-3, Herbicide-1 through Herbicide-6) during implementation would minimize potential disturbance concerns within Sacramento Mountains checkerspot butterfly habitat. Herbicide treatments would be applied directly to sprouts as opposed to broadcast treatments. Hence, herbicides are not expected to directly impact Sacramento Mountains checkerspot butterfly. Indirect impacts to Sacramento Mountains checkerspot butterfly from foraging in treated areas may impact individuals, but herbicide treatments would not be extensive. Although the project area is outside Sacramento Mountains checkerspot butterfly habitat, resource protection measures (Public-3, Herbicide-1 through Herbicide-6) would adhere to the outside Sacramento Mountains checkerspot butterfly conservation plan direction. In addition, only U.S. Environmental Protection Agency–registered herbicides approved for forest lands and that have been evaluated through the Lincoln National Forest risk assessment would be used (U.S. Forest Service 2017a). Indirect impacts to Sacramento Mountains checkerspot butterfly, such as human disturbance, would be localized and short term, resulting from crews and equipment during project implementation.

Effects from Other Restoration Methods

Other restoration methods such as site rehabilitation and tree planting, watershed improvement and erosion control, water developments, recreation sites, and interpretive sites, are unlikely to have short-term direct adverse impacts to the species due to resource protection measures (measures SOP-7 through SOP-18, Veg-1, Veg-6, Veg-7, Veg-10 through Veg-12, Rx-3, Rx-6, Rx-9, Road-2 through Road-4, Road-8, Road-15 through Road-16, Road-18, Road-20, Plant-1 through Plant-5, Soil-1 through Soil-3, Water-1 through Water-8, Wildlife-5, Wildlife-11) designed to avoid and protect the species. Long-term indirect effects of site rehabilitation and watershed improvement would be beneficial to the species by restoring watershed and hydrologic function, which would improve the resistance and resiliency of Sacramento Mountains checkerspot butterfly habitat to the adverse effects of drought. Other activities such as water developments and recreation and interpretive sites, may have long-term indirect impacts to the species by creating more local human and livestock activity, potentially decreasing suitable habitat characteristics due to trampling, soil compaction, and introductions of nonnative plant species.

Effects from Special Use Authorizations

Potential locations for forest industry activities, such as sorting yards, log processing sites, and mobile incinerator sites, would be identified to facilitate utilization of the forest resources and increase transportation efficiencies. These sites would require authorization by the Forest Service through existing contracting or special use permitting processes. No direct effects on Sacramento Mountains checkerspot butterfly are expected as resource protection measures (measures SOP-7 through SOP-10, SOP-14 through SOP-18, Veg-1 through Veg-18, Rx-3, Range-3, Soil-2, Water-1, Water-5, Wildlife-11) are in place for wildlife. However, indirect impacts such as displacement of Sacramento Mountains checkerspot butterfly may occur. Any indirect impacts to Sacramento Mountains checkerspot butterfly from special use authorizations would be short term, and Sacramento Mountains checkerspot butterfly could move to other parts of the Lincoln National Forest when forest industry activities occur in the project area. No long-term impact to Sacramento Mountains checkerspot butterfly is anticipated as these activities would not be long term in nature. Indirect impacts to Sacramento Mountains checkerspot butterfly, such as human disturbance, would be localized and short term, resulting from crews and equipment during forest industry activities.

Effects from Road Management

Road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities. Temporary roads would be rehabilitated after implementation and any new system roads or spurs constructed would only be used for project implementation. None of the temporary or system roads constructed as a result of this project would be open to public use. Vegetation treatments and road management activities associated with the proposed action may temporarily displace Sacramento Mountains checkerspot butterfly in the short term. For road maintenance and decommissioning activities, heavy machinery may be used at times when the soil is not dry or frozen, but must be kept strictly to existing compacted road surfaces (i.e., would not enter the shoulder of the road) in occupied habitat. However, Sacramento Mountains checkerspot butterfly may be able to move to other parts of the forest to avoid disturbance associated with the management of roads. Resource protection measures (measures SOP-7, SOP-14, SOP-15, Veg-2, Veg-10, Veg-11, Road-1 through Road-23, Water-1, Water-5, Wildlife-11, Wildlife-15) are in place to help minimize impacts to individual and local populations during road management activities. Human disturbance to Sacramento Mountains checkerspot butterfly would be localized and short term, resulting from crews and equipment during project implementation. Because roads would be closed to public use or rehabilitated, human disturbance would cease after site-specific treatments are completed.

Determination of Effects

Given that important habitat features would be protected and that overall habitat conditions would be improved in the long term, it is expected that the population trend for the Sacramento Mountains checkerspot butterfly on the Lincoln National Forest would remain stable under the proposed action. Additionally, the proposed vegetation treatments have been designed to retain and promote future development of suitable habitat. Resource protection measures would be implemented to minimize impacts to the Sacramento Mountains checkerspot butterfly as described above. This project **may impact individuals, but is not likely to cause a trend to federal listing or loss of viability** to the species or its habitat. Impacts from the proposed action for Sacramento Mountains checkerspot butterfly on the Lincoln National Forest are considered short term, and populations are expected to remain stable as a result of the improved habitat conditions. Some individuals of this species may be impacted, but the majority of the species population will be maintained.

Neo-tropical Migratory Birds and Bald and Golden Eagles

Alternative 1 – No Action

Because this alternative proposes no action, this alternative would not directly affect migratory birds or their habitat. However, the no action alternative also does not propose necessary treatments needed for sustaining or enhancing habitat, e.g., grasslands and forest openings used for foraging and nesting habitat would continue to be lost due to encroachment by shrubs and trees.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action would have temporary effects of noise and visual disturbance (i.e., heavy equipment use, chainsaws), human activity, and smoke from fires. Adult birds would avoid these disturbances during project periods. There could be unintentional take of some individuals, especially to ground-dwelling species, or to nesting species if activities would take place during the breeding season. Following the resource protection measures (measures Rx-4, Soil-3, Water 2, Wildlife 2 through Wildlife-10, Wildlife-11, Wildlife-14) when and where possible would help minimize these impacts. The vegetation treatments would create opening of canopy resulting in increased ground cover, shrubs, and increased distribution of aspen. These actions would increase foods (berries, seeds, and insects), nesting sites, and cover over a large portion of the project area, which would benefit migratory birds. The proposed watershed improvements would address the large headcuts occurring throughout the project area, including within the Peñasco Canyon Important Bird Area. Additionally, the proposed water developments would benefit birds by increasing water availability and distribution.

While the vegetation treatments may disturb and displays birds during implementation, bird communities would also move into sites after treatment to use the improved habitat and foraging opportunities created by the vegetation treatments. During implementation, project activities may slightly alter activity of neo-tropical migratory birds and bald and golden eagles primarily during active periods. Nests or eggs may be dislodged by mechanical thinning, and prescribed burning may destroy active nests during project activities. However, unintentional take would not rise to a level that affects the total population size for the species.

The proposed forest plan amendment to allow treatments within Mexican spotted owl protected activity centers, herbicide use to treat oak and juniper resprouts, and mechanical treatments on slopes greater than 40 percent would have both short-term adverse effects and long-term beneficial effects on migratory birds and eagles. Short-term, minor adverse effects would include modification of habitat and noise disturbance from treatment implementation. Long-term beneficial effects would include the improved nesting and forage habitat and the reduced threat of habitat loss from high-intensity wildfires.

According to the Forest Service Region 3 Species Database (Nature Conservancy 2006), the Lincoln National Forest is home to at least 257 birds. Of the 133 bird species currently on the New Mexico Species and Biodiversity Conservation Lists, 76 (or 57 percent) can be found on the Lincoln National Forest. This accounts for 30 percent of the known 257 bird species that inhabit the forest. Twelve species occur on both the Priority Watch List and the New Mexico Species and Biodiversity Conservation Lists, two of which are also sensitive species for forests in Region 3. These 12 species are described in Table 3-36. Additionally, Table 3-37 includes two species protected by the Bald and Golden Eagle Protection Act and Table 3-38 includes two species that were previously listed on the Priority Watch List and are still of concern.

Table 3-36. Migratory Birds of Conservation Concern Known to Occur on the Lincoln National Forest

Priority Bird Species (Conservation Concern Level)	Habitat and Nesting Requirements	Applicable Ecological Response Units	Habitat Impacts	Impacts to Birds, Nests, or Eggs
Band-tailed pigeon (*Patagioenas fasciata*) Priority Watch List SC2	Inhabits area where acorns and pine nuts are available for foraging. Nests are typically placed in conifers, 15 to 40 feet up, often in areas of lower tree density such as around clearings or forest edges.	Pinyon-Juniper Woodland; Gambel Oak Shrubland; Dry Mixed Conifer; Wet Mixed Conifer	Habitat would be modified with implementation of the proposed action because nuts and berries provided by pinyon and juniper trees would be reduced overall, compared with current conditions.	Treatments occurring during the nesting season could result in the direct loss of nests and mortality of young. Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.
Cassin's finch (*Haemorhous cassinii*) Priority Watch List BC2	Found in Douglas-fir, spruce, and ponderosa pine, but prefers pinyon-juniper areas dominated by pinyon. Nest site is in trees. They need tall coniferous trees for nest site, adjacent to meadows or forest openings for foraging. Forages on the ground, in herbaceous vegetation, shrubs, and cones in coniferous trees.*	Mixed Conifer, Ponderosa Pine, Pinyon-Juniper	Beneficial habitat: large trees, den/nest/roost; Habitat: small forest openings;Vegetation management; Fire, prescribed and natural burns;Vegetation Seral Stage: early;*Limiting factors are lack of a high temperature for breeding season, the need for open ground for foraging and tall trees for nesting.	Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.
Black-chinned sparrow (*Spizella astrogularis*) Priority Watch List SC2	Predominantly uses desert scrub habitat, including nesting in desert shrub. However, is frequently transient in areas of desert scrub and rocky slopes near Ponderosa Pine-Douglas Fir Forest.* The black-chinned sparrow is a ground forager.	Rocky slopes near Ponderosa Pine and Mixed Conifer	Available pine nuts and juniper berries for foraging would be reduced in the short term. However, the proposed action would help maintain and benefit the species by maintaining and creating foraging and nesting habitat, as this species prefers early successional forest that would come in after vegetation treatments (burning and thinning).*	May be displaced during implementation as it is sensitive to human presence/activity.
Chestnut-collared longspur (*Calcarius ornatus*) - winter Priority Watch List SC1	The chestnut-collared longspur forage and nest in grasslands. They are said to be accidentally transient in areas of desert scrub/rocky slopes and juniper savannas in mountain Ponderosa Pine-Douglas Fir Forest between 5,000 and 6,000 feet.* They are ground nesters and foragers in open grassland and shrubland areas, including areas disturbed by fire or grazing.	Ponderosa Pine Pinyon-Juniper Woodlands and Grasslands	Available pine nuts and juniper berries for foraging would be reduced in the short term. However, the proposed action would help maintain and benefit the species by maintaining and creating foraging and nesting habitat, as this species prefers early successional forest that would come in after vegetation treatments (burning and thinning).*	Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.
Flammulated owl (*Psiloscops flammeolus*) Priority Watch List SC1	Open old-growth ponderosa pine and mixed conifer. Nests in cavities excavated by woodpeckers in fairly large-diameter trees, usually 10 to 20 feet off the ground in ponderosa or pinyon pine snags.	Wet Mixed Conifer; Dry Mixed Conifer; Ponderosa Pine Forest; Pinyon-Juniper Woodland	Nesting habitat would be modified with implementation of the proposed action if cavity trees used as nests are impacted by proposed management activities. However, large-cavity trees (greater than 18 inches DBH) would not be removed, sparing nesting habitat.	Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.

Priority Bird Species (Conservation Concern Level)	Habitat and Nesting Requirements	Applicable Ecological Response Units	Habitat Impacts	Impacts to Birds, Nests, or Eggs
Grace's warbler (*Setophaga graciae*) Priority Watch List SC1	Ponderosa pine and mixed conifer when ponderosa are also present. Prefers Gambel oak understory. Nests are typically well hidden in outer foliage of upper branches, 26 to 39 feet high in ponderosa pines. It has been recently observed in mixed conifer with aspen forest stands.	Dry Mixed Conifer; Ponderosa Pine Forest; Pinyon-Juniper Woodland; Gambel Oak Shrubland	The treatment actions would cause short-term negative impacts to habitat but would benefit the Grace's warbler and its habitat in the long term through greater resiliency of ponderosa pine forests and protection from wildfire in the long term.	Could result in nest destruction and clutch mortality if treatment actions are conducted during the nesting season.
Gray vireo (*Vireo vicinior*) Priority Watch List SC2 Region 3 Sensitive Species	Near Timberon and on south side of project area. Most often found in arid juniper woodlands on foothills and mesas between 5,500 to 7,000 feet, preferring habitat with open, mature juniper savannah with a shrubby understory and well-developed grass component. Nests are placed in small forks in low trees or shrubs, often less than 10 feet off the ground. The gray vireo is an insectivore. It has been seen near Timberon and the southern part of the project area when not wintering in southwestern Arizona and northwestern Mexico.	Pinyon-Juniper Woodland	The proposed action would thin pinyon-juniper woodlands, potentially increasing herbaceous productivity and forage quality. Short-term impacts may displace individuals.	Could result in nest destruction and clutch mortality if treatment actions are conducted during the nesting season.
Long-eared owl (*Asio otus*) Priority Watch List BC2	Long-eared owls require a combination of grassland for foraging and dense tall shrubs or trees for nesting and roosting. Long-eared owls take over nests built in trees by other birds. Pine stands are preferred for winter roost habitat. Shrubby lowland habitats. Long-eared owls eat mostly small mammals. They hunt over open ground or below the canopy in sparsely forested areas. They are found in Douglas-fir, hemlock-Sitka spruce, redwood, ponderosa pine, larch/white pine, lodgepole pine, fir-spruce, aspen (hardwoods), chaparral, and pinyon-juniper forest types.*	Ponderosa Pine Forest; Mixed Conifer; Pinyon Juniper Woodlands and Grasslands	The proposed action would thin pinyon-juniper woodlands, potentially increasing herbaceous productivity and forage quality.	Noise and the presence of humans during project implementation would displace the long-eared owl.*
Olive-sided flycatcher (*Contopus cooperi*) Priority Watch List BC2	Ponderosa pine and mixed conifer forests, especially open forests with edges and snags. Nests are most frequently placed in the top half of conifers, on horizontal branches far from the trunk.	Wet Mixed Conifer; Dry Mixed Conifer; Ponderosa Pine Forest	A portion of the project area is located in suitable olive-sided flycatcher nesting habitat. This species is likely to benefit from the creation of more small forest openings and edges and reduced canopy cover.	Treatments occurring during the nesting season could result in the direct loss of nests and mortality of young. Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.

Priority Bird Species (Conservation Concern Level)	Habitat and Nesting Requirements	Applicable Ecological Response Units	Habitat Impacts	Impacts to Birds, Nests, or Eggs
Pinyon jay (*Gymnorhinus cyanocephalus*) Priority Watch List SC1 Region 3 Sensitive Species	Pinyon-juniper woodlands. Nests in pinyon, juniper, and ponderosa pine trees, usually concealed under or amid thick canopies. Threats from changing forest conditions. It is strongly tied to pinyon pine forests as a major seed disperser in that ecosystem.†	Dry Mixed Conifer; Ponderosa Pine Forest; Pinyon-Juniper Woodland	A portion of the project area is located in suitable pinyon jay habitat. Pinyon jay nesting habitat would be retained in the area, and preferred foraging habitat would be improved with a reduction in pinyon density because large, mature trees would be retained.	Treatments occurring during the nesting season could result in the direct loss of nests and mortality of young. Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season. The treatment would benefit the pinyon jay and its habitat in the long term since it would result in resiliency of pinyon-juniper woodlands and protection from wildfire. Prescribed burns conducted to reduce ground-level fuel loads may help prevent hotter fires that would kill pinyon pines.
Red-faced warbler (*Cardellina rubrifrons*) Priority Watch List SC1	Ponderosa pine and mixed-conifer forests, especially with complex structure and deciduous trees such as Gambel oak or aspen. They nest in a small hole or scrape on the ground, often with an overhanging rock, log, or grass clump for concealment.	Ponderosa Pine Forest and Mixed Conifer	The primary adverse effects would be temporary removal of dense shrubs resulting from prescribed fires or mechanical treatments. However, this habitat would regrow following disturbance. Prescribed fires are unlikely to occur in the hot late spring or summer months when temperature and humidity are at unacceptable levels for prescription burns, which would reduce the negative impact to the shrub layer.	Some nests and clutches may be destroyed if treatment actions are conducted during the nesting season.
Virginia's warbler (*Leiothlypis virginiae*) Priority Watch List SC1	Pinyon-juniper, ponderosa pine, even mixed conifer wherever Gambel oak understory is present. Nests are generally in fairly open habitat with deciduous shrubs, Gambel oak, New Mexico locust, as well as pines and junipers.	Dry Mixed Conifer; Ponderosa Pine Forest; Pinyon-Juniper Woodland; Gambel Oak Shrubland	The primary adverse effects would be temporary removal of dense shrubs resulting from prescribed fires or mechanical treatments. However, this habitat would regrow following disturbance. Prescribed fires are unlikely to occur in the hot late spring or summer months when temperature and humidity are at unacceptable levels for prescription burns, which would reduce the negative impact to the shrub layer.	Some nests and clutches may be destroyed if treatment actions are conducted during the nesting season.

* Information from Biota Information System of New Mexico (2018).
† Information from Cornell Lab of Ornithology (2015)

Table 3-37. Bald and Golden Eagles Known to Occur on the Lincoln National Forest

Priority Bird Species	Habitat and Nesting Requirements	Applicable Ecological Response Units	Habitat Impacts	Impacts to Birds, Nests, or Eggs
Bald eagle (*Haliaeetus leucocephalus*) Regional Foresters Sensitive Species	Typically associated with water, though may use tall forest trees for winter roosting and foraging. While bald eagles have been seen overwintering near a lake east of the project area, there are no known nest or recorded sightings of them in the project area.	Montane/Subalpine Grassland; Dry Mixed Conifer; Pinyon-Juniper Grassland	Migratory, foraging, and possible nesting habitat could be disturbed by the proposed action, including prescribed burns and vegetation treatments. There are winter bald eagle migrants on the Lincoln National Forest. No bald eagle nests are currently known on the Lincoln National Forest, although there are five bald eagle roost sites that are known on the Lincoln National Forest.	Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.
Golden eagle (*Aquila chrysaetos*)	May use large trees at elevations from 4,000 to 10,000 feet for nesting; typically found in mountainous regions of open country using rock ledges and cliffs. May also use grasslands during winter. Golden eagles are known to occur on the Guadalupe and Smokey Bear Ranger District; however, there are no known nests or recorded sightings in the project area or on the Sacramento Ranger District.	Montane/Subalpine Grassland; Dry Mixed Conifer; Pinyon-Juniper Grassland	Migratory, foraging, and possible nesting habitat could be disturbed by the proposed action, including prescribed burns and vegetation treatments. Golden eagles are common on the Lincoln National Forest and use cliffs for nesting habitat.	Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.

Table 3-38. Other Species Not on the Partners in Flight Watch List or New Mexico Avian Conservation Partners Conservation Lists

Priority Bird Species	Habitat and Nesting Requirements	Applicable Ecological Response Units	Habitat Impacts	Impacts to Birds, Nests, or Eggs
Swainson's hawk (*Buteo swainsoni*)	Mixed grassland, shrubland, and agricultural fields are needed for forages and nesting. Swainson's hawks breed in open pine-oak woodlands, grasslands, and shrublands adjacent riparian woodlands. Nesting occurs on isolated trees, preferably 30 to 50 feet tall. Nests are often in close proximity to water (streams).*	Pinyon-Juniper Grassland	Adverse: Rights-of-way; habitat change (e.g., forest to shrub); Beneficial: Prescribed fire can be beneficial to Swainson's hawk populations by enhancing habitat and increasing the prey base. Burning in grasslands where scattered trees are retained benefits Swainson's hawk populations, particularly in areas where nesting sites are limited. Requires open grassland patches with low or no shrub encroachment. Loss of native nesting and foraging habitat, and changes in land uses from agricultural to urban are key reasons for population declines in Swainson's hawks. Possibly the most critical factor is the loss of many suitable nesting trees within preferred riparian habitat.	Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.

Priority Bird Species	Habitat and Nesting Requirements	Applicable Ecological Response Units	Habitat Impacts	Impacts to Birds, Nests, or Eggs
White-throated swift (*Aeronautes saxatalis*)	Nests in cliffs and rocks in mid-elevation forested areas and forages widely over adjacent forests.	Wet Mixed Conifer; Dry Mixed Conifer; Ponderosa Pine Forest; Pinyon-Juniper Woodland	The project area is located in white-throated swift nesting habitat; however, rocky areas would probably not be treated due to steep slopes, difficulty of access, and sparse trees. Additionally, management activities would not be expected to affect foraging swifts because this species feeds high above the tree canopy.	Activity near an occupied nesting site could cause nest abandonment if activities are conducted during the nesting season.

* Information from Biota Information System of New Mexico (2018).

<u>Summary of Effects</u>

The activities associated with the proposed action may disturb nests and disrupt courtship of nesting pairs. However, in many situations the proposed action may also lead to increased activity by the above species almost immediately after project implementation by improving foraging habitat through the use of fire and mechanical thinning. The proposed action would spread vegetation treatments across the project area, occurring in different locations at different times. Hence, birds can move to other areas to avoid disturbance, and post-treatment, these areas are expected to provide better habitat by creating openings and enhancing the development of large trees. Resource protection measures (e.g., Mexican spotted owl and northern goshawk breeding season restrictions) will help offset some of the effects of the proposed action on the above species. The impacts from the proposed action are expected to be infrequent and will not rise to a level that affects the total population size for any species.

Cumulative Effects Common to All Wildlife Species

The area of consideration for cumulative effects of the action alternative is the Lincoln National Forest, Sacramento Ranger District. Cumulative effects analysis includes the past, present, and reasonably foreseeable future actions on the Sacramento Ranger District and on adjacent lands. Only those actions identified as having a measurable impact to wildlife are included in the analysis of this evaluation.
The spatial boundary for analyzing the cumulative effects is the Sacramento Ranger District, as it represents a reasonable region in which the wildlife species, when assessed in combination with other cumulative actions, would be impacted if the proposed project were implemented. The effects analysis applies to all ecological response units. The temporal boundary for analyzing the cumulative effects is 30 years, because restoration methods are anticipated to have taken effect in that time period. The direct effects, indirect effects, and cumulative effects of the project with other non-project-related effects, on wildlife species, are evaluated under this same spatial and temporal context.

See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on wildlife species.

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 other projects may lead to cumulative adverse impacts to wildlife, depending on resource protection measures of those other projects that are designed to protect species. Restoration activities would occur on adjacent public lands, including the Rio Peñasco 2 Project, Jim Lewis Fuel Reduction Project, Two Goats Forest Restoration Project, and Westside Watershed Restoration Project restoration treatments, treatment of nonnative invasive plants, and other activities as described in Table 3-1.

Past actions, including fire suppression, timber harvests, insect and disease attacks, power line installation, water extraction, livestock grazing, and construction of range improvements have contributed to the current environmental conditions and many of these past actions are likely to continue in the reasonably foreseeable future. Past wildfires, floods, and other natural disturbances have also contributed to current conditions in the project areas. The locations of future wildfires cannot be foreseen and the need for specific wildfire management or suppression activities cannot be predicted. Therefore, the potential impacts of emergency wildfire responses on wildlife species cannot be evaluated. A separate decision support process is used to guide and document wildfire management decisions (Fire Executive Council 2009).

Thinning treatments and prescribed fire activities on the forest, adjacent state lands, and tribal lands should further increase long-term forest health as a result of reduced uncharacteristic wildfire risk, which could improve the forest's resiliency in a changing climate and decrease the potential for soils to erode and create sediment problems within streams and riparian areas. The overall long-term cumulative effects from these other projects should result in beneficial effects on wildlife through improved habitat conditions, although there may be minor short-term increase in soil erosion and compaction, and water runoff and sedimentation while these treatments are being implemented and possibly for several years afterward until natural regeneration stabilizes disturbed soils or until site rehabilitation takes place. Combined, these projects would treat up to approximately 94,000 acres over the next decade. However, thinning treatments and prescribed fire activities on the adjacent project areas, including on federal, state, and tribal lands, would work to improve the forest's resiliency in a changing climate; thereby resulting in long-term benefits to wildlife through improved habitat. Cumulative impacts from thinning could occur for cavity nesters if suitable nest trees are removed from the landscape. Impacts are expected to be minor because suitable nest trees are often large in size and therefore would not be removed from precommercial or other small-diameter thinning treatments or because such trees tend to have low commercial value and would usually be left in place. Cumulative impacts to species dependent on large trees, snags, or downed woody debris would be minor in the short and long term because all federal activities must comply with the minimum retention standards for these habitat components from the Forest Plan. In the long term, cumulative effects from all fuel reduction projects on the forest would be the restoration of a more fire-adapted ecosystem and wildlife habitat that is more resilient to disturbances including insects and disease, stand-replacing wildfire, and drought.

Other restoration activities (such as watershed and stream improvements and site rehabilitation activities); road construction and maintenance; and recreation activities are sporadic over time and generally affect a limited area for short durations. Special uses authorizations also typically affect limited areas although the activities can occur over a long duration, often years or decades or repeated disturbance within a limited scope. This is true for both the proposed project and for activities that are already authorized or may be authorized in the foreseeable future. While some cumulative impacts may occur, the impacts are expected to be minimal due to the small extent of the activities.

Herbicides used to treat nonnative invasive plants on federal, state, and private lands may contribute to short-term cumulative adverse effects on wildlife through loss of forage and/or hiding coverage for the species or for prey. However, the use of herbicides to treat nonnative invasive plants and to treat juniper and oak resprouts may also reduce their presence of undesirable or unpalatable vegetation on the landscape, thereby improving wildlife habitat conditions over the long term.

Historic livestock grazing has contributed to the current conditions on the landscape. The intensity of livestock grazing within the project area is expected to remain at current levels into the foreseeable future. Ongoing and future livestock grazing may cumulatively impact wildlife in combination with project restoration treatments though competition for forage (either for grazing species or prey) or through further habitat alteration. Livestock grazing is not expected to have a cumulative impact on the reproduction or displacement of cavity nesters because these activities do not lead to a loss of nest trees. However, cumulative effects are possible for ground-nesting birds through the additional loss of suitable nesting cover. Birds of prey could be cumulatively impacted through the additional loss of available prey. Domestic livestock grazing may pose a threat to the species or their prey bases due to trampling and consumption of individual plants by livestock, trampling and compaction of wetland soils that damages habitat for the species, and livestock management (supplemental feeding and transportation of animals leading to heavy use in concentrated areas). However, proposed thinning, prescribed fire, and herbicide treatments are expected to create additional forage and improve habitat over the long term, thereby lessening the long-term cumulative impacts of habitat alteration and forage competition.

All project activities have the potential to temporarily displace larger and highly mobile animals, including game species and other medium- to large-sized mammals, bats, most birds, and many insects, while activities are taking place. These species are expected to recolonize treated areas when the disturbances cease. The same impacts are anticipated to occur in other project areas and wherever human activity is occurring. Since human activities are widely distributed within and adjacent to the project area, wildlife is not expected to be fully displaced from the project area or adjacent lands since large expanses of areas will remain available where minimal human activities are taking place at any given time. Therefore, cumulative impacts to large or highly mobile species would most likely occur for individuals while cumulative impacts to populations are less likely.

Smaller, less-mobile animals and those with high site fidelity (such as small mammals, northern goshawks, riparian and stream-obligate species, some invertebrates, reptiles, and amphibians) are expected to remain in the vicinity of any human activity and will likely experience greater impacts from the South Sacramento Restoration Project but less impact from other human activities unless they occur within the same general area. Cumulative impacts to individuals are less likely because exposure to other activities would be less as compared to effects on large and highly mobile species. Cumulative impacts for small and less-mobile species may be expected at the population level rather than at the individual level. Cumulative impacts to populations could be both short and long term in this case. However, the resource protection measures for the South Sacramento Restoration Project are designed to minimize soil disturbance and improve habitat conditions, which would minimize any adverse cumulative impacts that would occur from project implementation to any species over the long term.

Although individuals and small groups of animals could be affected, no cumulative impacts to population trends for any wildlife species are anticipated.

Conclusion

Table 3-39 summarizes the impact determinations provided for the proposed action for management indicator species. Table 3-40 summarizes the impact determations provided for the proposed action for Forest Service sensitive species.

Table 3-39. Management Indicator Species with Potential to Occur in the Project Area and the Impact Determinations for Each Species

Species	Known or Potential Occurrence Likely	Impact Determination for Proposed Action
Elk	Yes	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.
Mule deer	Yes	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.
Red squirrel	Yes	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.
Juniper titmouse	Yes	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.
Pygmy nuthatch	Yes	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.
Rufous-crowned sparrow	Yes	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.
Hairy woodpecker	Yes	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.
Mexican vole	Yes	Some individuals of this species may be impacted, but the majority of the species population will be maintained and will recover quickly.

Table 3-40. Forest Service Sensitive Animal Species with Potential to Occur in the Project Area and the Impact Determination for Each Species

Species	Known or Potential Occurrence Likely	Impact Determination for Proposed Action
Sacramento Mountains salamander	Yes	This project may impact individuals but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
Northern goshawk	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
Gray vireo	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
Bald eagle	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
Pale Townsend's big-eared bat	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
Spotted bat	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
Western red bat	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
New Mexico shrew	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
Ruidoso snaggletooth snail	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.
Sacramento Mountains checkerspot butterfly	Yes	This project may impact individuals, but is not likely to cause a trend to federal listing or loss of viability to the species or its habitat.

Maintaining and improving wildlife habitat is one of the primary purposes of the project. Implementation of vegetation treatments would pose adverse impacts in the short term for these species and habitat, however, these impacts would be temporary, and species are expected to return to treated areas after implementation. Overall, resource protection measures would be applied to minimize these potential impacts. The proposed action would improve habitat in the long term for all management indicator species and sensitive species, by creating a more resilient forest habitat, closer to desired conditions for the forest type.

3.6.4 Forest Plan Amendments

The following amendment components would have the potential to affect wildlife species and their habitats:

- Incorporating new or modified guidance for the management of northern goshawk habitat;
- Incorporating new or modified U.S. Fish and Wildlife Service direction, including the use of a broader range of treatment options over extended time frames in Mexican spotted owl habitat;
- Updating management direction for essential habitat for federally listed species;
- Using ground-based, mechanized equipment on slopes greater than 40 percent; and
- Using herbicides to treat juniper and oak resprouts within municipal watersheds so this restoration tool could be used as appropriate across the entire project area.

The amendment components that would allow ground-based mechanized equipment to be used on slopes greater than 40 percent and allow forest restoration treatments to occur in Mexican spotted owl protected activity centers, northern goshawk habitat, and treatments within other essential habitat for federally listed species would result in short-term negative impacts as well as long-term beneficial impacts to wildlife species. Allowing treatment to occur on steeper slopes would provide for landscape restoration opportunities that otherwise would not be possible. Impacts would be similar to the direct and indirect vegetation treatment effects already described for each species. Noise and human presence would likely displace wildlife while treatments are in progress. There is also potential for impacts to breeding success and to foraging opportunities for wildlife while site-specific treatments are occurring. However, thinning treatments on steep slopes are expected to benefit wildlife over the long term by improving habitat conditions and reducing the risk of stand-replacing wildfire in areas that would otherwise not be treated.

The proposed changes to herbicide use direction would include authorizing treatment of juniper and oak resprouts within municipal watersheds, near areas of human habitation, or wherever needed to maintain treatments where juniper and oak species exceed desired conditions. In general, small mammals, reptiles, amphibians, and invertebrates could see the greatest impacts from herbicide use due to their small size and potential to come into direct contact with these chemicals or by consuming treated vegetation. Additionally, other wildlife species that prey on these organisms could be affected as described in the direct and indirect effects for each species. The impacts from implementing this amendment component would have the same length and intensity as the direct and indirect effects of herbicide use already described for each species.

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to other wildlife species from the no action alternative and proposed action. Maintaining and improving wildlife habitat is one of the primary purposes of the project. However, implementation of vegetation treatments would also pose adverse impacts in the short term for wildlife species and habitat. Thinning and burning would alter and reduce available forage for wildlife species in the short term. Reducing vegetation and changing stand composition would impact species that require closed-canopy forest. Additionally, thinning and burning could cause some loss of mature or old-growth forest, large snags, and coarse, woody debris that is needed by nesting species and provides food and perches for birds and other species. The proposed action could cause accidental take of nesting and migratory birds in the area. Road maintenance activities, noise, and presence of humans and equipment would disrupt and displace wildlife during implementation. However, these impacts would be temporary, and wildlife are expected to return to treated areas after implementation. Overall, project conservation measures would be applied to minimize these potential impacts.

The proposed action also includes water developments, which would benefit wildlife by dispersing them into habitat that has not been used due to the lack of available water. These developments would open up new habitat that can be used for foraging, browsing, nesting, and cover. Despite the short-term adverse impacts, there would be long-term benefits to wildlife species and habitat from the project. As stated before, reducing the risk of stand-replacing fires and insect and disease outbreaks will allow the forested ecosystem to be more resilient and better able to recover from disturbance, which in turn will support healthy habitat conditions for a diversity of wildlife, not just those that favor closed-canopy, dense forest stands, which is currently the trend in the project area.

3.7 Air Quality and Climate

The air quality and climate specialist report (U.S. Forest Service 2018e) is incorporated by reference. See the report for detailed information about data sources, methodology, assumptions, and limitations.

3.7.1 Affected Environment

Air Quality

The project area lies within the El Paso-Las Cruces-Alamogordo Interstate Air Quality Control Region 153 (New Mexico Environment Department 2017). Although the New Mexico Environment Department Air Quality Bureau does not conduct any regional air quality monitoring in the area, Otero County has been classified by the U.S. Environmental Protection Agency as an “attainment area,” which means that ambient air quality meets the standards of the levels set in the National Ambient Air Quality Standards (U.S. Environmental Protection Agency 2017a). Most air pollution in the Sacramento Ranger District originates outside the district’s boundaries, with point source, mobile, and fugitive dust emissions being the primary causes of air pollution from urban centers such as El Paso, Las Cruces, and Juarez or industrial counties that contain a significant amount of oil and gas operations in the Permian Basin in eastern New Mexico and west Texas (U.S. Forest Service 2016c).

The project is located in the Sacramento Mountains east of Alamogordo. Elevations range from about 7,000 feet near Timberon to just under 10,000 feet on Cathey Peak.

In mountainous terrain, winds are often influenced by the differential heating of slopes. In general, upslope and up-canyon winds can be expected on sunny afternoons, whereas downslope and down-canyon winds develop overnight and continue until around sunrise. The average wind pattern from the nearest Remote Automated Weather Station at the Apache Point Observatory, from 2010 through 2017, is presented in Figure 3-34. The prevailing winds typicall blow from southwest to northeast (southwesterly winds). Given the lack of wind daily pattern data for the Sacramento Mountains, the mountain winds can generally be characterized as flowinf down drainage during the evenings, with inversion that tend to trap cool air close to the ground surface into the morning.

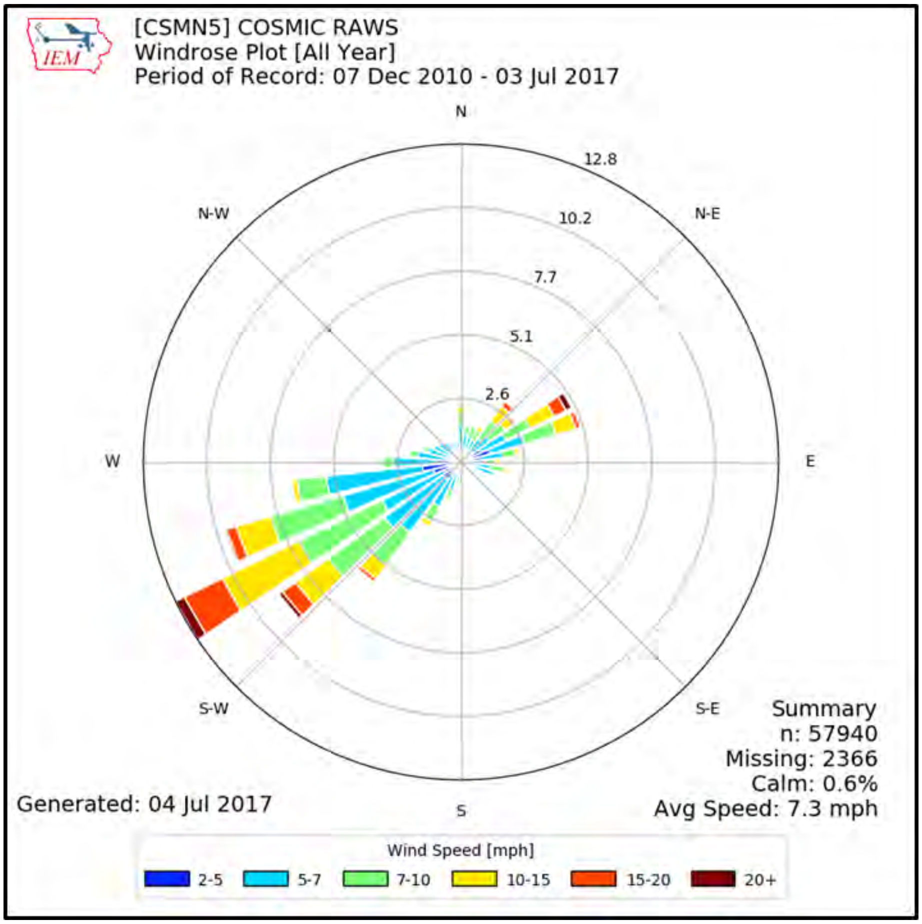

Figure 3-34. Wind rose data from remote automated weather station at the Apache Point Observatory (Iowa State University 2017).

The primary concern from this project from an air quality perspective is smoke from prescribed fire. In conducting the effects analysis, smoke sensitive receptors or resources within the potentially affected area that may be sensitive to smoke impacts were identified. Sensitive receptors include populations or specific places, views, hospitals, airports, schools, highways, or businesses that would likely be impacted by smoke coming from the project area. There are several sensitive receptors that could potentially be impacted by poor air quality associated from prescribed fire. Generally, those communities nearest a given project, particularly those down drainage, would have the greatest impacts (e.g., Weed, Timberon, Mayhill, and Cloudcroft). However, potential impacts farther away in Otero County, including the communities of Alamogordo, Tularosa, and Mescalero, could be expected.

Class I airsheds, established by the Clean Air Act and administered by the U.S. Environmental Protection Agency, apply to national parks over 6,000 acres and certain wilderness areas and memorial parks over 5,000 acres that require the highest level of aesthetic protection (Federal Land Manager Environmental Database 2017). Figure 3-35 shows the Class I airsheds within 50 miles of the proposed project area (U.S. Environmental Protection Agency 2017b). They are:

- White Mountain Wilderness (managed by the Forest Service), approximately 40 miles north of the project area; and
- Carlsbad Caverns Wilderness (managed by the National Park Service), approximately 60 miles southeast of the project area.

Air Emissions from Fire

Smoke is a mixture of fine particulates and gases, and it contains a wide range of pollutants, which can remain suspended in the atmosphere anywhere from a few seconds to several months. The pollutants in the greatest amount produced during combustion of organic material, such as would be found in smoke from a wildfire, include carbon dioxide (CO_2), particulate matter, nitrogen oxides (NO_X), and hydrocarbons. Lead, sulfur dioxide (SO_2), and other compounds, including toxics and carcinogens, are also contained in wood smoke but in such small amounts that they are less of a concern in terms of their effect on human health than particulate matter.

While many of these pollutants, as well as some toxic pollutants, are present in smoke from wildland fire, $PM_{2.5}$ is the pollutant of greatest concern and is the most likely to result in public health impacts. $PM_{2.5}$ has an aerodynamic diameter of 2.5 microns or less and can become imbedded deep in the lungs. $PM_{2.5}$ is a major component of smoke and is produced in large quantities in both prescribed fire and wildfires. It also has the ability to be dispersed great distances due to its small size, which enables particulates to stay aloft in the atmosphere over long distances.

Particulate matter has the potential to impair human health and visibility. PM_{10} causes eye, nose, and throat irritation. Because of its relatively larger size, it remains in the upper respiratory tract. $PM_{2.5}$, due to its smaller size, travels to the lungs and can cause more serious health impairments, especially in individuals with pre-existing health issues related to the respiratory and circulatory system. Exposure to $PM_{2.5}$ is associated with premature death, heart attacks, and stroke (Brook and others 2004; Pope and others 2002; Pope and others 2004). Additionally, it can trigger asthma attacks among those with asthma and respiratory problems (Delfino and others 2009; Elliott and others 2013).

Most particulate matter emissions in the Lincoln airshed are associated with fugitive and windblown dust (e.g., wind erosion and re-entrained dust from traffic on streets and roadways) and wildland fires (U.S. Forest Service 2016c). The annual average $PM_{2.5}$ concentrations were generally 8 micrograms per cubic meter or less at both sites between 2009 and 2015 (U.S. Environmental Protection Agency 2015). These readings are well below the National Ambient Air Quality Standards of 12 micrograms per cubic meter.

Visibility

Under the Clean Air Act, the national visibility goal is to return visibility in Class I areas to the "natural background condition" no later than 2064. To meet this goal, the Clean Air Act has instituted measures for emissions control at large stationary sources that contribute to visibility impairment.

The Interagency Monitoring of Protected Visual Environments (IMPROVE) program has been monitoring visibility conditions in Class I wilderness areas in New Mexico and nationwide since the late 1980s. The White Mountain Wilderness IMPROVE site on or near the Lincoln National Forest is most useful for considering potential visibility conditions near the project area. IMPROVE data for the White Mountain Wilderness are provided in the air quality and climate specialist report (U.S. Forest Service 2018e).

In general, the IMPROVE data show relatively good visibility conditions (8 deciviews or better), except on the haziest 20 percent days (U.S. Forest Service 2016c). The general trend in visibility has been toward moderately improving conditions on the clearest days. However, the trend on the haziest days is toward slightly hazier conditions. Further analysis of the types of pollutants causing the visibility impairment as well as the months when the haziest days occur indicates that the haziest days are a result of ammonium sulfate (typically associated with industrial and mobile pollution), coarse mass (typically associated with windblown and fugitive dust), and organic carbon (typically associated with wildfire smoke) (U.S. Forest Service 2016c).

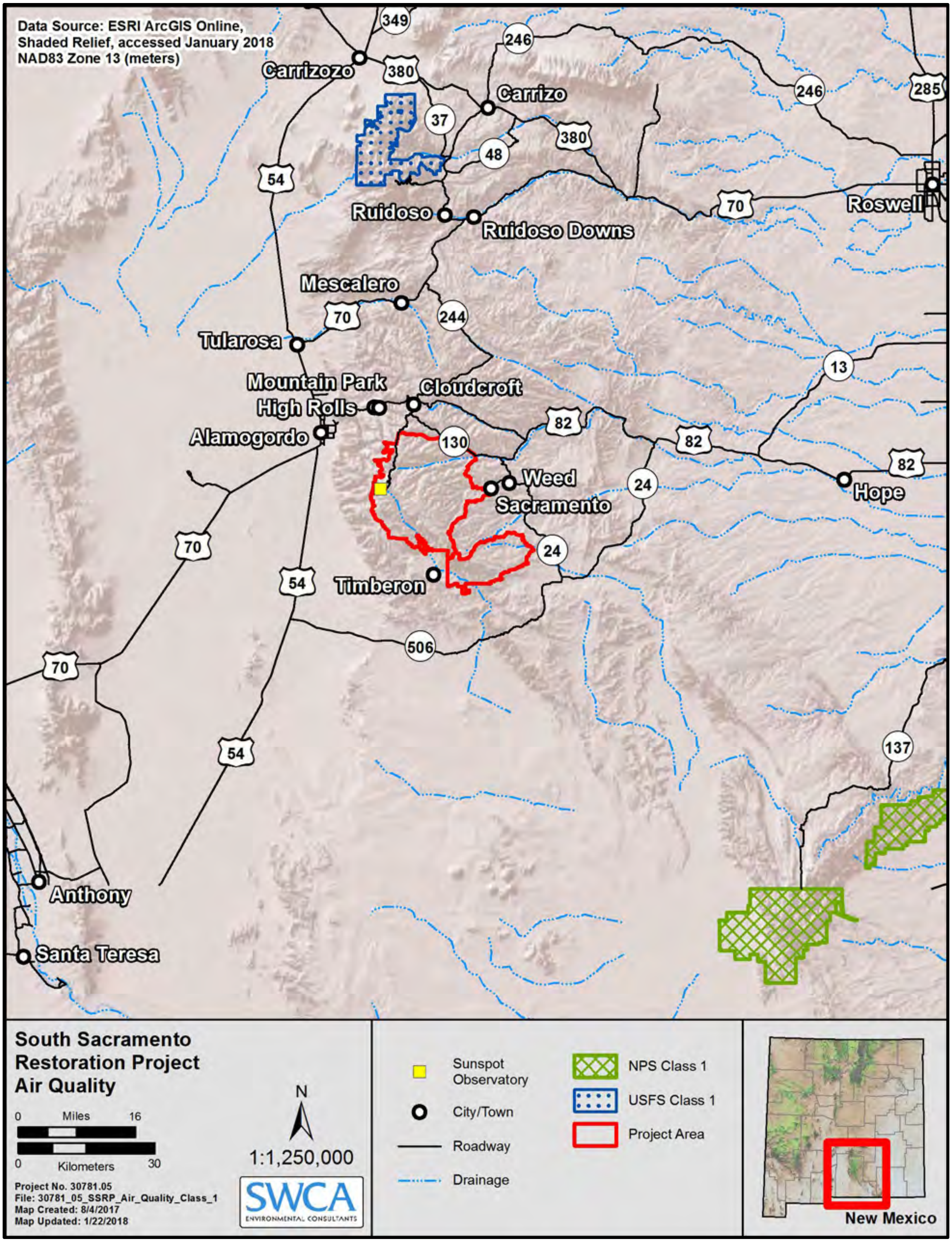

Figure 3-35. Class I airsheds within 50 miles of the project area.

Climate Change

The burning of fossil fuels and land use changes has caused elevated levels in atmospheric concentrations of CO_2 and other greenhouse gases (Intergovernmental Panel on Climate Change 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 (U.S. Forest Service 2010b).

In recent decades, outbreaks of insects and pathogens have resulted in millions of hectares of forest defoliation, canopy dieback, declines in growth, and forest mortality in western North America. In many cases, climate was a direct or indirect trigger for these other agents of disturbance or influenced the severity and extent of outbreaks (Millar and Stephenson 2015).

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, the region is on a trajectory of warmer and drier conditions (Gutzler and Robbins 2011; Jones and Gutzler 2016).

Based on current projections, the primary regional-level effects of climate change most likely to occur in the Southwest include warmer temperatures, similar precipitation but increased aridity, decreased water availability with increased demand, and increased extreme disturbance events (Gutzler and Robbins 2010; Jones and Gutzler 2016). These climate change factors could, in turn, affect ecological functions, weather-related disturbances, and socioeconomic demands (Garfin and others 2014; Joyce and others 2014), 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.

Exposures to climate-related changes have been quantified for the Sacramento Ranger District in the Summary of Socio-Economic Vulnerability to Ecological Changes Draft Report (U.S. Forest Service 2018f) as follows:

- Future climate conditions within the District range from a moderate to very high likelihood to fall outside the range of conditions that support current vegetation types.
- Much of the District has a very high or high potential for experiencing extreme fire behavior.
- The majority of montane forest vegetation within the Sacramento Ranger District has a high to very high likelihood of vegetative change.

Furthermore, the Climate Change Vulnerability Assessment for the Lincoln National Forest indicates that the six principal sixth-level watersheds within the project area have a high vulnerability to projected climate departure from the historic climate envelope (see Figure 3-4) (U.S. Forest Service 2017c).

Incomplete or Unavailable Information

Characterization of the affected environment for the analysis area is based on best available information. There are no permanent air quality monitoring stations within or near the project area. $PM_{2.5}$ data were available from two monitoring sites (Las Cruces and Hobbs) over the period 2009 to

2015. PM_{10} data have been collected at two sites (Las Cruces and Franklin Mountain) near the forest areas of interest since 2009 (U.S. Environmental Protection Agency 2015). Particulate matter monitoring data from these sites do not necessarily represent air quality in the Lincoln National Forest. However, particulate matter data have been provided as a reference of nearby air quality with the potential to impact air quality values in the forest (U.S. Environmental Protection Agency 2015).

Air quality emissions from toxics known to be present in smoke, such as metals (including mercury, radionuclides, and byproducts of accelerants), are not expected to approach federal and state ambient air quality standards or result in long-term public health impacts. Direct modeling of impacts from toxics was not done, due to the high level of uncertainty in such an analysis, both in terms of quantifying the amounts both produced and estimated concentrations downwind, and the high degree of uncertainty quantifying health impacts. In addition, since significant impacts have been shown from particulate matter from smoke from wildfire and prescribed fire, it was determined that the analysis should focus on those pollutants, rather than pollutants not known to have resulted in significant impacts.

Although it is possible to quantify the project's direct effects on CO_2 emissions, there is no certainty about the actual intensity of individual project indirect effects and linkage to global climate change, and such an analysis is not essential to a reasoned choice among alternatives (U.S. Forest Service 2009), given the projected contrast in emissions among alternatives including the no action alternative and the availability of this information to the responsible official.

3.7.2 Methodology and Assumptions Used for Analysis

The spatial boundary for analyzing the direct and indirect effects on air quality is the project area (140,000 acres), extended to include the communities of Weed, Cloudcroft, Timberon, Mayhill, Alamogordo, Tularosa, and Mescalero.

The temporal boundaries for analyzing the direct and indirect effects are the duration of prescribed fire or wildfire events for short-term impacts and 2 to 20 years for long-term impacts. The proposed project is expected to last approximately 20 years with follow-up maintenance of treatment acres to occur after 20 years.

Table 3-41 identifies the resource indicators and measures that are used to conduct impacts analysis for air quality and climate change. The resource indicators and measures were developed in collaboration with the Forest Service interdisciplinary team.

Table 3-41. Resource Indicators and Measures for Assessing Effects

Resource Element	Resource Indicator	Measure (Quantify if possible)
Air Quality	Particulate matter emissions	$PM_{2.5}$ emission estimates
Air Quality/Climate Change	CO_2 emissions	CO_2 emission estimates
Visibility	Change in visibility	Qualitative discussion
Air Quality	Public health impacts	Qualitative discussion

In addition to the quantified impact indicators discussed above, the analysis will include a qualitative discussion of potential contributions of ozone from fire management activities.

On the topic of climate change, the analysis will focus on carbon accounting for each alternative per Forest Service Handbook 1909.12. The contribution of CO_2 and other greenhouse gases from the project to the global concentration of greenhouse gases that affect climate is an indirect effect of the project and will be discussed qualitatively.

Consume, version 4.2, a software program, was used to model the two alternatives. Consume is a fuels model commonly used to estimate smoke emissions.

Alternatives were varied by acres for prescribed fire and those acres that were harvested and then treated with prescribed fire. The wildfire scenario had the same footprint (area) as the prescribed fire alternatives and assumed that 13 percent of the area burned with high severity, as informed by the ecosystem model developed for the proposed action. Emission estimates were provided for low and high canopy consumption conditions; therefore, the results reported in the Environmental Consequences section provide a range of potential impacts to air quality. A complete set of assumptions and outputs for all pollutants modeled is in the project record (Hall 2017a).

Ozone concentrations from prescribed fire under the proposed action are not expected to approach federal and state ambient air quality standards; direct modeling of ozone was not completed due to high levels of uncertainty associated with the models. In addition, past wildfires in the area have not resulted in impacts to ozone concentrations in the analysis area, so it was assumed that emissions from prescribed fire are not likely to result in significant impacts to ozone concentrations in the analysis area (Hall 2017b).

Vehicle emissions associated with roadwork and equipment used for mechanical treatments, thinning, and harvesting forest products are not expected to approach federal and state ambient air quality standards. Impacts from these types of emissions were not directly modeled, except for carbon dioxide, to illustrate the emissions relative to those from prescribed fire.

Fugitive dust from roadwork is not expected to approach federal and state ambient air quality standards. Impacts from these types of emissions were not directly modeled. This is also due to the high degree of uncertainty associated with such an analysis and the fact that 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.

The following information sources were used to develop this report:

- Data provided by Forest Service staff at the Sacramento Ranger District, Lincoln National Forest, and Southwestern Region
- CO_2 and $PM_{2.5}$ emissions estimates from the Forest Service Consume software
- Scientific papers

3.7.3 Environmental Consequences

Alternative 1 – No Action

Under the no action alternative, the proposed forest restoration activities would not occur within the project area. Therefore, no long-term beneficial impacts to air quality would occur because there would be no actions taken to reduce the risk of high-intensity wildfire within the South Sacramento Restoration Project area. Short-term adverse impacts to air quality would be likely to occur under the no action alternative as a result of wildfires within the project area. Table 3-42 summarizes the impacts to air quality and climate change from the no action alternative. Detailed discussions of impacts to air quality, visibility, and climate change follow the table.

Table 3-42. Resource Indicators and Measures for the No Action Alternative

Resource Element	Resource Indicator (quantify if possible)	Measure (quantify if possible)	Alternative 1 Direct/Indirect Effects
Air Quality	Particulate matter emissions	$PM_{2.5}$ emission estimates	26,950 to 32,3201 tons from wildfire None from prescribed fire
Air Quality/Climate Change	CO_2 emissions	CO_2 emission estimates	3.9 million to 4.9 million tons from wildfire None from prescribed fire
Visibility	Change in visibility	Qualitative discussion	Compromised visibility during wildfire events; potential adverse impacts to Class I areas
Air Quality	Public health impacts	Qualitative discussion	Smoke impacts could cause health issues during wildfire events, which have an unknown duration

Air Emissions from Fire

Wildfire risk would continue to occur in the project area; therefore, adverse impacts to air quality would occur in the event of an unplanned wildfire. Approximately 50,181 acres within the project area have been identified as at risk to stand-replacing, uncharacteristic wildfire (U.S. Forest Service 2017g) under the no action alternative. Based on estimates from the Consume software, approximately 26,950 tons (0.24 ton per acre) to 32,301 tons (0.29 ton per acre) of $PM_{2.5}$ would be emitted from wildfire events over 20 years if the entire South Sacramento Restoration Project area was to burn in that time frame. As described above, $PM_{2.5}$ is a human health concern because it can enter the lungs and can cause more serious health impairments, especially in individuals with pre-existing health issues related to the respiratory and circulatory system. Emissions of $PM_{2.5}$ from the no action alternative are not expected to exceed state or federal air quality standards.

Ozone has been associated with smoke from wildfire. Although ozone is not directly produced by wildland fire, precursors of ozone are found in smoke. Ozone is formed by the interaction of nitrogen oxides and volatile organic compounds in the presence of sunlight. Both nitrogen oxides and volatile organic compounds are produced from wildland fire. Ozone production from wildland fire is a complex process involving numerous variables, including fire emissions, chemical and photochemical reactions, aerosol effects on chemistry, and local and downwind meteorological patterns (Jaffe and Widger 2012). Wildfires have been shown to contribute to ozone concentrations downwind; however, predicting it is a challenge (Jaffe and Widger 2012). Ozone has been shown to result in a number of health effects and symptoms across a wide range of the population, including inducing respiratory symptoms such as coughing, pain, discomfort, and tightness in the chest, inflammation of the lung, loss of lung function, and asthma attacks (U.S. Environmental Protection Agency 2014). Emissions of ozone from the no action alternative are not expected to exceed state or federal air quality standards.

Visibility

Visibility would likely be compromised during wildfire, thereby potential adversely impacting nearby Class I areas, such as the White Mountain Wilderness and Carlsbad Caverns Wilderness. The lack of control over atmospheric and drought conditions when unplanned wildland fires begin increases their potential to contribute emissions to the local airshed. If a wildfire does occur under drought conditions, the wildfire could expand, causing adverse air quality and visibility impacts for as long as the wildfire event occurs. Spring and summer months are the haziest for White Mountain Wilderness (see Figure 3-35); therefore, smoke from wildfire during summer months could further contribute to hazy conditions in Class I areas (Finch 2018).

Climate Change

As presented in Table 3-42, the no action alternative would result in approximately 3.93 million (at 26 tons per acre) to 4.90 million (at 36 tons per acre) tons of CO_2 released over the 20-year project duration. To put this in perspective, in 2017, emissions of carbon dioxide by coal power plants in the United States were 1,207 million metric tons (U.S. Energy Information Administration 2018). No forest restoration treatments would be implemented under the no action alternative. Therefore, forest health conditions within the project area would continue to decline, causing the forest to be susceptible to the effects of climate change while the no action alternative contributes greater carbon to the atmosphere in an overall feedback system. Projected changes in climate and climate-driven changes in large wildfire frequency present major challenges to conifer forests in the western United States and are likely to exacerbate the current complex of stressors already impacting these forests (Hurteau 2017).

Alternative 2 – Proposed Action

Direct and Indirect Effects

Table 3-43 summarizes the air quality and climate change impacts from the proposed action. A detailed discussion of the resulting impacts, by resource indicator, follows the summary table. Implementation of the proposed action would result in particulate matter and CO_2 emissions from both wildfire events and prescribed fire. Smoke emissions would also result from proposed action, compromising air quality and visibility near the project area and possibly extending to Class I areas, especially during wildfire events. Long-term benefits of the proposed action include reduced pollutant emissions, including emissions of $PM_{2.5}$ and CO_2, compared with the no action alternative, over the 20-year project duration. Also, the proposed action would result in reduced smoke impacts to nearby communities due to reduced wildfire risk in the project area, compared with the no action alternative.

Table 3-43. Resource Indicators and Measures for the Proposed Action

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	Alternative 2 Direct/Indirect Effects
Air Quality	Particulate matter emissions	$PM_{2.5}$ emission estimates	17,930 to 21,790 tons from wildfire and prescribed fire
Air Quality/Climate Change	CO_2 emissions	CO_2 emission estimates	2.9 million to 3.6 million tons from wildfire and prescribed fire
Visibility	Change in visibility	Qualitative discussion	Compromised visibility during wildfire events; potential adverse impacts to Class I areas, although fewer than the no action alternative
Air Quality	Public health impacts	Qualitative discussion	Smoke impacts could cause health issues during wildfire events, which have an unknown duration

Air Emissions from Fire

Under the proposed action, smoke would be the primary impact to air quality from both prescribed burns and wildfire within the project area. Based on estimates from the Consume software, restoration activities under the proposed action would release approximately 17,930 tons (0.19 ton per acre) to 21,790 tons (0.23 ton per acre) of $PM_{2.5}$ from wildfire and prescribed fire events over 20 years (see Table 3-43 and Figure 3-36) in contrast to the no action alternative, which would release approximately 0.24 ton per acre to 0.29 ton per acre of $PM_{2.5}$. As described above, $PM_{2.5}$ is a human health concern because it can enter the lungs and can cause more serious health impairments, especially in individuals with pre-existing health issues related to the respiratory and circulatory system. As discussed for the no action alternative, ozone would also be generated under the proposed action; however, emissions of $PM_{2.5}$ and ozone from the proposed action are not expected to exceed state or federal air quality standards.

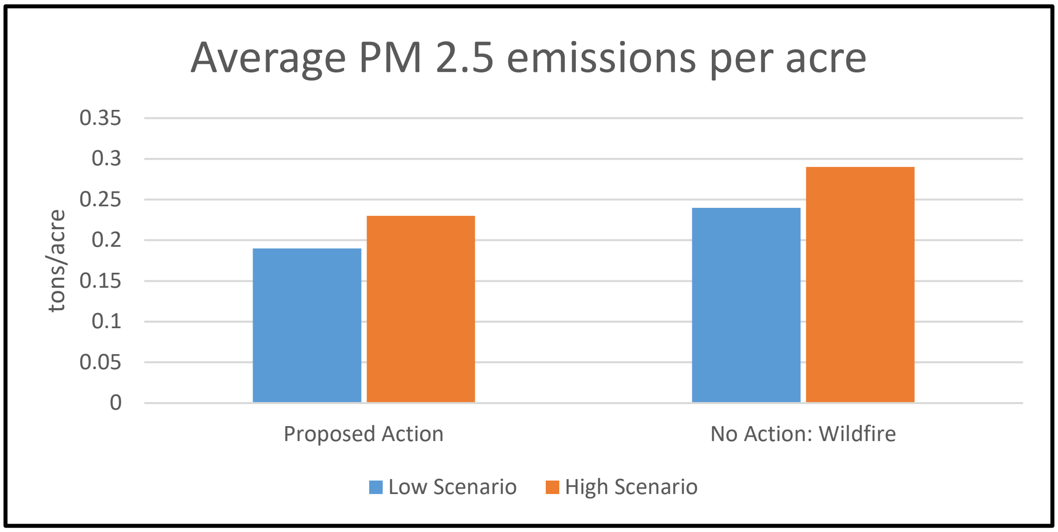

Figure 3-36. Average $PM_{2.5}$ emissions (per acre) from the proposed action, compared with the no action alternative over the 20-year project duration.

Mechanical fuel treatments and prescribed fire would have minimal impacts on air quality. The impact of smoke on local community members and visitors would depend on weather conditions when fires are active and an individual's sensitivity to smoke. The Forest Service would take measures to manage smoke impacts resulting from prescribed fire. Prior to implementing a prescribed fire, a prescribed fire plan would be written to follow the New Mexico Smoke Management Program's Guidance Document (New Mexico Environment Department 2005). This pre-implementation planning, and agency coordination would help ensure that appropriate conditions exist during implementation of a prescribed fire and the likelihood for lower air emissions, such as smoke, to migrate away from the site-specific burn area. Prescribed fires would be carefully evaluated to consider smoke dispersal into nearby communities, including Weed, Cloudcroft, Timberon, Mayhill, Alamogordo, Tularosa, and Mescalero. As a result, the effects on air quality from prescribed fire would be short term and localized near the prescribed fire area. The duration of the impact would coincide with the duration of prescribed burn activities.

Mitigation measures required by the New Mexico Smoke Management Program as well as those identified for the proposed action would minimize smoke impacts to sensitive receptors in the nearby communities. Fuels management and preparation of the treatment areas for prescribed burning could also improve the effectiveness of a response to unplanned wildfire by lowering fuel loading across the landscape, thereby resulting in beneficial impacts to regional air quality.

Under the proposed action, the risk of stand-replacing, uncharacteristic wildfire would be reduced when compared with the no action alternative as a result of the proposed forest restoration treatments. Implementation of the proposed action would result in a risk reduction of stand-replacing, uncharacteristic wildfire on approximately 27,000 acres within Mixed Conifer-Frequent Fire forests, and ponderosa pine forests (U.S. Forest Service 2017g). Approximately 23,280 acres within the project area would be at risk of stand-replacing, uncharacteristic wildfire at the end of the 20-year project duration, compared with the 50,181 acres currently at risk (U.S. Forest Service 2017g). This reduction in wildfire risk would likely result in a long-term benefit to air quality because fewer acres within the project area would have the fuel conditions needed to support uncharacteristic wildfires. Therefore, the likelihood of large, uncontrolled smoke emissions would be lower under the proposed action, compared with the no action alternative.

Wildfire management actions and prescribed fires would require the use of mechanical equipment, such as vehicles, mowers, engines, pumps, all-terrain vehicles, and bulldozers that would result in exhaust emissions, which may include nitrogen dioxide and sulfur dioxide, which are criteria pollutants. These emissions would be intermittent and temporary, lasting for the duration of fire management events. Emissions from the use of mechanical equipment would be small, relative to the emissions generated by prescribed burn and wildfire events. Emissions of other criteria pollutants resulting from the proposed action are not expected to exceed state or federal air quality standards.

Visibility

Similar to the no action alternative, wildfire would result in impacts to air quality within and near the project area. Management of wildfire could affect air quality and visibility on National Forest System land and the surrounding areas depending on the location of the fire and wind conditions. If a wildfire does occur, the wildfire could expand, causing adverse air quality and visibility impacts for as long as the wildfire event occurs. Visibility would likely be compromised during the wildfire, and depending on the size of the wildfire, the fire could adversely impact visibility at nearby Class I areas, such as White Mountain Wilderness and the Carlsbad Caverns Wilderness. The duration of the impact would coincide with the duration of the wildfire. Spring and summer months are the haziest for White Mountain Wilderness (see Figure 3-35); therefore, smoke from wildfire during summer months could further contribute to hazy conditions in Class I areas (Finch 2018).

The reduction in wildfire risk would like result in a long-term benefit to visibility conditions because 27,000 fewer acres within the project area would have the conditions needed to support stand-replacing, uncharacteristic wildfires; therefore, the likelihood of large, uncontrolled smoke emissions would be lower under the proposed action.

Prescribed fire events would be planned in such a way as to avoid or minimize impacts to visibility. Therefore, adverse impacts to Class I areas are unlikely to occur from prescribed fire activities proposed as part of the proposed action.

Climate Change

As presented in Table 3-43 above and Figure 3-37 below, the proposed action would result in approximately 2.85 million (at 21 tons per acre) to 3.56 million (at 29 tons per acre) tons of CO_2 released over the 20-year project duration.

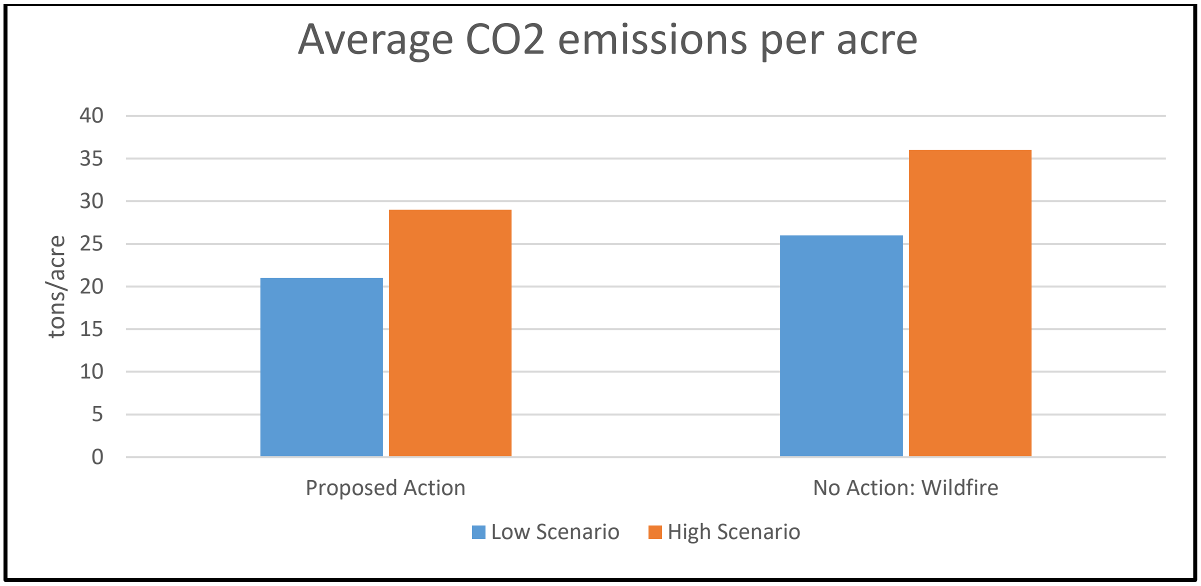

Figure 3-37. Average CO_2 emissions (per acre) from the proposed action, compared with the no action alternative over the 20-year project duration.

The Forest Service recognizes the vital role that our nation's forests and grasslands play in carbon sequestration, which is the direct removal of CO_2 from the atmosphere through biologic processes, such as forest growth. Carbon sequestration by forests is one way to mitigate greenhouse gas emissions by offsetting losses through removal and storage of carbon (U.S. Forest Service 2015b). Over at least the past several decades, temperate forests have provided a valuable ecosystem service by acting as a net sink of atmospheric carbon dioxide, partly offsetting anthropogenic emissions (Millar and Stephenson 2015). Carbon dioxide uptake by forests in the conterminous United States offset approximately 16 percent of our national total CO_2 emissions in 2011 (U.S. Environmental Protection Agency 2013). Forests and other ecosystems generally act as carbon sinks because, through photosynthesis, growing plants remove CO_2 from the atmosphere and store it (U.S. Forest Service 2015b).

Keeping forests as forests is one of the most cost-effective carbon storage measures. Restoration—bringing badly disturbed forests and grasslands back to producing a full range of environmental services—is another (U.S. Forest Service 2015b). The proposed project would be a restoration project that could result in carbon sequestration beyond the 20-year project duration. Even though practices such as thinning and prescribed fire may release carbon in the short term, they focus growth and storage for the future on trees that are at lower risk and/or are more resilient to disturbance. Previous research in southwestern ponderosa pine forest has demonstrated that a restored condition that is maintained by regular surface fire can store more carbon than a fire-suppressed condition when the effects of stochastic wildfire are incorporated (Hurteau 2017). Appropriate forest management and protection can substitute lighter, strategically placed, and more recoverable emissions for disturbance emissions that would be more severe, extensive, and less reversible (U.S. Forest Service 2015b). Because live trees continually sequester carbon and are a more stable carbon sink that dead biomass left on the site, treating stands is preferred for long-term mitigation of atmospheric carbon levels (Vegh and others 2013).

Additionally, reducing tree density through thinning has been shown to reduce drought stress and increase growth and carbon sequestration relative to a fire-suppressed condition during dry periods (Hurteau 2017). The restoration of forest structure and the maintenance of that structure with regular surface fire helped sustain the forest carbon sink, even under an increasingly hotter climate (Hurteau 2017).

The current suite of issues facing forest managers is likely to be compounded by ongoing climate change. In forests of the southwestern United States, increasingly large wildfires and drought already carry ecological and socioeconomic costs, costs that have the potential to rise with the changing climate. While managing forests for an uncertain climate future requires a diversity of approaches, the results of a recent study by Hurteau (2017) suggest that restoring forest structure and surface fire to southwestern ponderosa pine provides an opportunity to maintain system structure and function, even under the projected warmer, drier future, which is likely to have increased fire frequency.

Wood uses for products such as those supported by the proposed project can also complement land management by extending the storage of carbon in useful products and reducing emissions as wood products substitute for those that emit more CO_2 and other greenhouse gases. These considerations are important components of sustainable forest management (U.S. Forest Service 2015b).

Cumulative Effects

See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on air quality and climate.

The area of consideration for cumulative effects of the action alternatives is Otero County, including the communities of Weed, Cloudcroft, Timberon, Mayhill, Alamogordo, Tularosa, and Mescalero. Most of the air quality impacts effects discussed would be expected to occur within this county.

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 cumulative impacts on air quality. Restoration activities would occur on adjacent public lands, including the Rio Peñasco Two Project, Jim Lewis Fuel Reduction Project, Two Goats Restoration Project, and Westside Watershed Restoration Project restoration treatments, would also increase ecosystem resilience in the Sacramento Mountains. Combined, these projects would treat up to approximately 94,000 acres over the next decade. Mechanical treatments and other restoration activities on the adjacent state lands and tribal lands would further increase long-term air quality benefits as a result of reduced risk of wildfire as well as improved forest health, which could improve the forest’s resiliency in a changing climate.

Because of the small windows of opportunity for burning that exist in the Sacramento Mountains, it is possible that the federal, state, and local landowners 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. Fire hazard would be further reduced throughout the area.

3.7.4 Forest Plan Amendments

The Forest Plan amendment, which would allow mechanized equipment to be used on slopes greater than 40 percent in the project area to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives, would result in beneficial impacts to air quality and climate change conditions in the study area. Allowing treatment to occur on steeper slopes would provide access to fuels that otherwise would not be removed from National Forest System lands. By expanding the areas in which forest restoration would occur in the project area, wildfire risk would be reduced, and long-term beneficial impacts to air quality would result because high-intensity wildfires that produce large amounts of smoke would be less likely to occur. Furthermore, forest restoration activities on steep slopes would improve forest health and resilience in a larger portion of the project area, thereby resulting in increased carbon sequestration.

Similarly, the proposed amendments allowing forest restoration treatments to occur in Mexican spotted owl protected activity centers would result in beneficial impacts to air quality and climate change conditions because fuels in these areas would not be removed without the amendment. A long-term reduction in wildfire risk and beneficial impacts to air quality would result from the proposed amendment. Forest restoration activities within protected activity centers would improve forest health and resilience in a larger portion of the project area, thereby resulting in increased carbon sequestration.

The Forest Plan amendment to authorize the management of unplanned wildfires for multiple resource objectives across portions of the project area where this management is not currently authorized would also result in long-term reduction in wildfire risk and subsequent beneficial impacts to air quality.

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to air quality from the no action alternative and proposed action. The proposed action would result in beneficial air quality impacts over the 20-year life of the project. The benefits include reduced emissions of $PM_{2.5}$ and CO_2 and reduced wildfire smoke impacts from reduced wildfire risk in the project area. Short-term adverse impacts to communities could occur under either alternative, resulting from smoke impacts from either wildfire (no action alternative and proposed action) or prescribed burns (proposed action only).

3.8 Scenery and Visual Quality

The scenery and visual quality specialist report (U.S. Forest Service 2018g) is incorporated by reference. See the report for detailed information about data sources, methodology, assumptions, and limitations.

3.8.1 Affected Environment

Past and present intensive harvest and grazing, road building, and decades of wildfire suppression have resulted in even-aged, dense forests with closed canopies, limited views, and an overall lack of vegetative diversity.

The standards and guidelines for scenery resources call for creating and maintaining diversified textures of a forested landscape, managing ponderosa pine foregrounds for diversity, maintaining a variety of species, age classes, and size classes in mixed conifer foregrounds, and perpetuating aspen foregrounds and retaining or creating diversity in pinyon-juniper foregrounds by emphasizing open stands of mature trees. These conditions are not being met in most of the project area.

While acceptable variations in visual quality objective classifications outlined in Forest Plan standards and guidelines are being met for planned forest activities, it is unlikely that the visual quality objectives are being met in areas where there are insect infestations or unplanned wildfire.

Characteristic Landscape

The characteristic landscape (also referred to as landscape character under the Scenery Management System) is a description of the aesthetic, social, and biophysical attributes that give a place its identity. The characteristic landscape for the project is described below.

The landscapes of the project area have a wide variety of features, providing for spectacular scenery in the Southwest. The project area covers about 140,000 acres in south-central New Mexico, with elevations varying from 6,400 to 9,700 feet. Slopes in the project area are highly variable, with deeply incised canyons. Water is a precious and distinctive resource on the Lincoln National Forest (U.S. Forest Service 2013d). Most of the drainages within the project area are intermittent or ephemeral. Riparian vegetation persists along the Sacramento River, Agua Chiquita, and Rio Peñasco, and at scattered seeps and springs. Most of the riparian vegetation is herbaceous with little to no woody riparian vegetation.

The project area is composed of two ecological subsections: the Sacramento Mountains Coniferous Forest and the Sacramento Mountains Woodland Forest. A subsection is an ecological unit in the subregion planning and analysis scale of the National Hierarchical Framework corresponding to subdivisions of a Section into areas with similar surficial geology, lithology, geomorphic process, soil great groups, subregional climate, and potential vegetation.

Sacramento Mountains Coniferous Forest

The higher elevations of the Sacramento Mountains and a variety of canyons and valleys characterize this subsection on the Sacramento Ranger District. The west side of the subsection has a series of steep escarpments leading up to a high ridge, which includes the highest named point, Cathey Peak, at 9,645 feet. From this north-south-running ridge, the mountains slope gently down to the east, merging with the plains to the east. Vegetation patterns range from grasslands, pinyon pine, juniper, and oak to aspen, spruce, fir, and high-elevation grasses and forbs. In the fall oaks, maples, and aspens add breathtaking colors to the mountainous landscape. The terrain varies from gently to moderately sloping hills to steep, rugged canyons, and mountain slopes. The mountainous landscapes and high-elevation vegetation mix make for distinctive scenic attractiveness over much of the area.

The Sunspot Scenic Byway winds along the front rim of the Sacramento Mountains, providing astounding views of the Tularosa Basin and the sand dunes of White Sands National Monument and access to the Sunspot Solar Observatory. The high-elevation, conifer-covered mountains and rugged canyons of the Sacramento Mountains provide for distinctive scenic quality and are a primary recreation destination, offering a rich cultural landscape with unique heritage features.

Sacramento Mountains Woodland Subsection

This ecological subsection covers the lower elevations of the Sacramento Ranger District. Rolling hills, lower-elevation mountain peaks, mountain foothills, and narrow, steep canyons and drainageways characterize the area. An abrupt, steep escarpment is a dominant and distinctive landscape feature running along the western edge of the Sacramento Mountains east of Alamogordo. Vegetative patterns are mostly pinyon pine and juniper woodlands, with semi-desert plants at lower elevations.

Water is a valued resource within this subsection. Rio Peñasco and the Sacramento River are in the project area. Many intermittent streams are found throughout the subsection. Driving for pleasure and viewing scenery is popular along the Sunspot Highway.

Visual Quality Objectives

Visual quality objectives are the measurable standards for the visual management of landscapes. These objectives describe the degrees of acceptable alteration of the natural landscape, as referenced in Table 3-44. The degree of alteration is measured in terms of visual contrast with the surrounding natural landscape. The degree of visual contrast is ascertained by rating the change in visual elements of line, form, color, and texture between the existing landscape and the landscape after project implementation.

Visual quality objectives are assigned by management area in the Forest Plan (Figure 3-38). Approximately 23,723 acres (17 percent) are managed as “Retain,” 79,430 acres (57 percent) as

"Partial Retain," and 25,362 acres (18 percent) as "Modification." The remaining acreage/percent is private or state lands. Table 3-44 summarizes the visual quality objectives by management area for the project area.

Table 3-44. Visual Quality Objectives by Management Area in the Project Area

Management Area	Retain	Partial Retain	Modification	Total	Percentage of Project Area
Sacramento	11,164	9,849	231	21,244	15.3
Alamo	12	1,378	42	1,431	1.0
Lick Ridge	1,807	8,871	21,906	32,583	23.5
Grapevine	42	858	2,448	3,348	2.4
Lower Aqua Chiquita	444	822	–	1,266	0.9
Upper James	22	204	–	226	0.2
Bluewater	0	83	722	805	0.6
Mountain Park	2	21	–	23	< 1.0
Upper Peñasco	8,051	33,691	–	41,742	30.1
James/Peñasco	1,030	4,677	–	5,707	4.1
Upper Aqua Chiquita	1,125	18,676	12	19,813	14.3
Carissa	24	300	1	324	< 1.0
Total (National Forest Land Only)	**23,723**	**79,430**	**25,362**	**128,512**	**100**

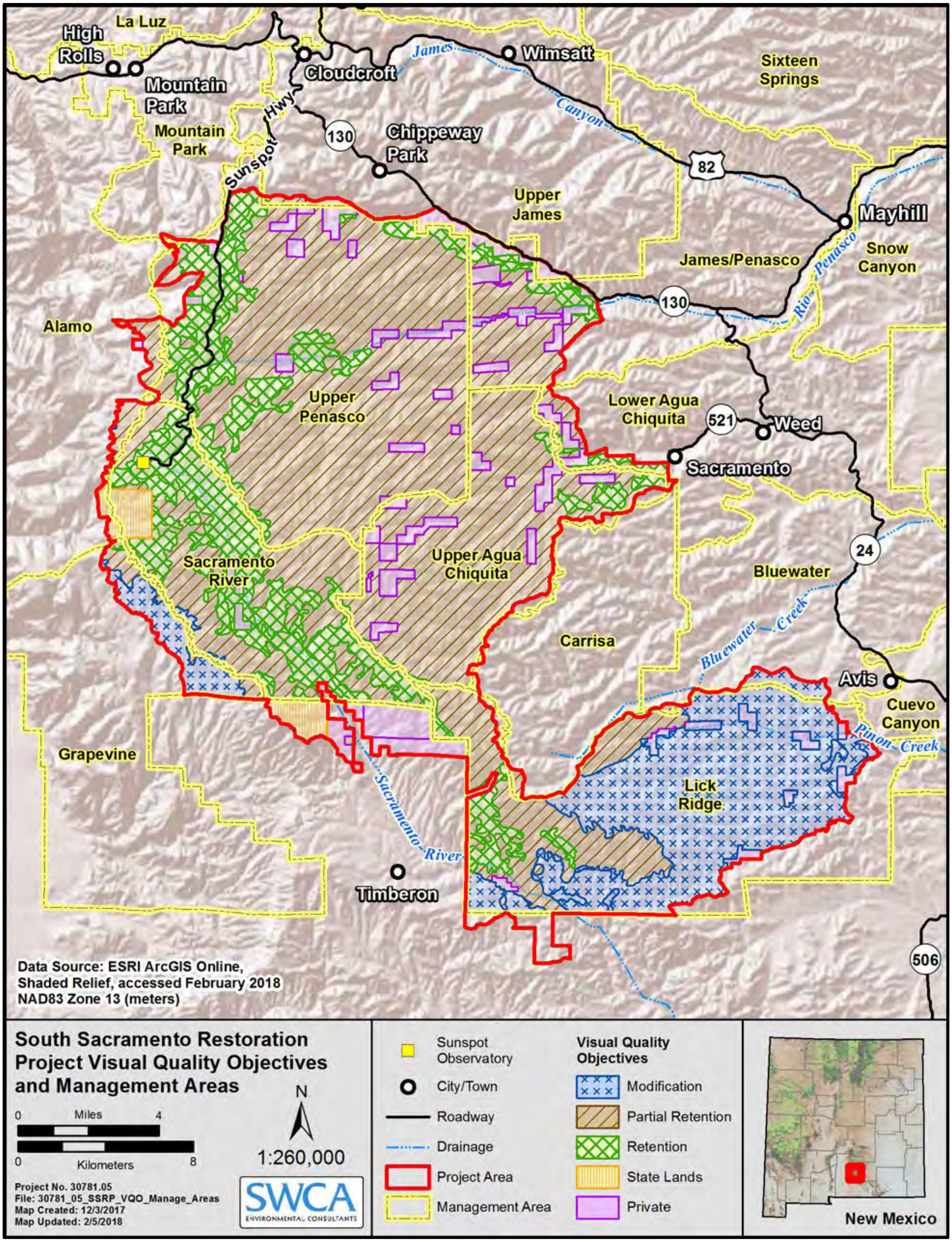

Figure 3-38. South Sacramento Restoration Project visual quality levels (objectives) and Lincoln National Forest management areas.

Scenic Benefits

High-quality scenery, especially scenery with natural-appearing landscapes, enhances people's lives and benefits society. Research findings support the logic that scenic quality and naturalness of the landscape directly enhance human well-being, both physically and psychologically, and contribute to other important human benefits. Specifically, these benefits include people's improved physiological well-being as an important by-product of viewing interesting and pleasant natural-appearing landscapes with high scenic diversity (U.S. Forest Service 1995b).

Scenery is the valued visual expressions (sights) people enjoy within places. Many landscape preference studies have shown striking uniformity in the type and composition of landscapes people find visually appealing. There are four common aspects of visually preferred settings:

- Large trees
- Herbaceous, smooth groundcover
- Open mid-story canopy with high visual penetration
- Vistas with distant views and high topographic relief

In contrast, "landscapes usually considered less visually appealing are wide-open areas with uniform or monotonous vegetation" (Ryan 2005, page 13). All landscapes have a definable character and those with the greatest variety or diversity have the greatest potential for high scenic value (U.S. Forest Service 1974). Visitors to the Lincoln National Forest expect to see and value natural-appearing landscapes.

Research on forest aesthetics demonstrates a significant consensus about what the public considers to be a scenic forest. These factors are outlined in the scenery and visual quality report (U.S. Forest Service 2018g) and include the presence of large mature trees and a more open forest structure, as well as thresholds on the level of forest thinning, the amount of downed wood, and the intensity of prescribed fire.

3.8.2 Methodology and Assumptions Used for Analysis

The scenery and visual quality analysis uses photographs, geographic information system (GIS) data, digital elevation models from Google Earth, and examples from other restoration projects to determine the visibility of effects from the proposed action and its alternative. As stated in Chapter 2, treatments could be implemented in any location of the project area. The effects of each treatment type represent the type and extent of effects they would have on the landscape character.

The analysis of effects is based on how well the alternatives would achieve the desired landscape character, rehabilitate or restore compromised landscapes, and maintain or improve existing scenic integrity to meet visual quality objectives. Vegetation and fuels treatments and roads have the ability to affect the desired landscape character and scenic integrity of landscapes within the project area. Several assumptions are used for the analysis, as outlined in the scenery and visual quality report (U.S. Forest Service 2018g).

The primary resource indicator for determining the project's effect is compliance with visual quality objectives. Secondary resource indicators include the potential for the landscape to meet the desired conditions for landscape character after project implementation and an increase or decrease in scenic benefits to the public.

Visual quality objectives define the degrees of deviation in form, line, color, scale, and texture that may occur from implementing the project. Activities that leave the landscape intact with only minute deviations or with deviations that repeat the line, form, color, texture, and pattern would be considered negligible or minor impacts. Activities that alter the landscape but remain visually subordinate or co-dominant would be considered moderate impacts. Activities that heavily alter the landscape would be considered major impacts.

Table 3-45 outlines the resource indicators and measures for assessing impacts from the Landscape Scenery Handbook (U.S. Forest Service 1995b).

Table 3-45. Resource Indicators and Measures for Assessing Effects

Resource Element	Resource Indicator	Measure (quantify if possible)	Used to Address: Purpose and Need, or Key Issue?	Source
Characteristic Landscape	Enhancement of existing landscape character achieved	Changes in scenic attractiveness	No	Scenery Handbook
Visual Quality Objectives	Determine whether areas of Retain or Partial Retain classes would be significantly or irreversibly altered. *Note there are no Very High (Preserve) acres in the project area.*	Degree of contrast in line, form, color, and texture	No	Scenery Handbook
Scenic Benefits	Quality of life and recreation experience	Qualitative discussion about the adverse and beneficial effects of the proposed project on public perception	No	Scenery Handbook

3.8.3 Environmental Consequences

Alternative 1 – No Action

If the proposed action were not implemented, the project area would continue to be mostly natural-appearing for several years. Important scenery attributes such as open and diverse overstory vegetation and healthy understory would continue to have overly dense growing conditions, and views into and out of the forest would be blocked by trees. The large, old tree character that historically contributed to the characteristic landscape and attractiveness of the area would be limited. Historic fire regimes would not be reestablished, which would limit nutrient recycling and allow the density of forest fuels to increase. Stream channels would remain sparsely vegetated due to existing forest density. There would be no potential for a more diverse understory plant component. Social and recreational scenic benefits would continue to diminish. Visual quality objectives would be more difficult to maintain in Retain and Partial Retain areas.

At some point, overstocked vegetative conditions may be attacked by insects or disease or may experience an uncharacteristically large, intense wildfire that would burn much of the vegetation that is the dominant scenic attribute. While some insect and disease activity occurs every day, the overly dense conditions, combined with extreme weather events characteristic of climate change, could allow these to escalate and become widespread. Large, high-intensity fires have become more common with increasing tree density and lack of a regular fire regime. Large-scale events such as these would be outside the range of historic variability.

No amendments would occur under this alternative.

Alternative 2 – Proposed Action

Alternative 2 would implement treatments to restore the structure and function of forests and watersheds in the project area. Restoration activities would focus on thinning and burning treatments to improve forest health and resiliency by reducing stand density, continuity, and homogeneity (sameness of forest structure and species composition) and to increase heterogeneity (diverse forest structure and species composition). Details on the treatments and the methods used are described in Chapter 2.

Direct and Indirect Effects

Vegetation thinning, prescribed fire, herbicide use, and other restoration treatments would cause short- term and indirect visual effects (0 to 2 years) that would include:

- Sights of slash, tree stumps, woody debris piles, and equipment (e.g., skidders, etc.)
- Surface disturbance caused by equipment and tree removal
- Direct views of skid trails, landings, and temporary roads
- Tree removal
- Low-intensity smoke
- Tree scorch, burnt soil, and blackened understory
- Dead and dying vegetation and dead standing trees

Approximately 54,000 acres of National Forest System lands in the project area would be subject to vegetation thinning. There would be short-term direct and indirect moderate visual impacts from the sights of slash and equipment while the treatments occur. The existing vegetative screening of roads, trails, and other disturbances would be temporarily decreased or eliminated once trees are removed.

Major visual impacts would be created from skid trails, landings, and temporary roads that are slow to rehabilitate, partially due to soil disturbance and compaction, leaving areas devoid of vegetation. However, resource protection measures (Standard Operating Procedures) outlined in Section 2.2.5 would reduce soil disturbance and compaction by promptly rehabilitating and stabilizing disturbed areas as needed following project activities. Soils would be contoured to disperse runoff, minimize erosion, stabilize slopes, and provide a favorable environment for plant growth. Where visual observation indicates that vegetation on disturbed areas is not naturally recovering to limit erosion, Forest Service-approved weed-free materials and controls would be used on the site. In the long term, using measures to prevent further disturbance, visual impacts could be reduced to the level where they would not be noticed by a casual observer after 5 to 10 years. In addition, by removing trees and creating a diversity of openings in the forest canopy, understory vegetation is expected to fill in and actually improve screening in the long term.

The landscape character would temporarily change to a more industrialized setting due to the equipment used for thinning and the sights of slash, tree stumps, and woody debris. Scenic benefits and visitor experiences would be diminished in the short term. The scenic integrity in areas of visual quality objective Retain would be altered because of the visual contrasts created in line, form, color, and texture. The characteristic landscape would not be enhanced during this period. Visual quality objectives would not be met in Retain or Partial Retain classes and may not be met in the Modification class.

There would be beneficial direct and indirect impacts from vegetation thinning in the long term. Thinning would extend the depth of view into the forest and create openings for potential vistas. The thinning would allow for larger trees to grow and thrive. Open space would be created, most residual slash and all equipment would be gone. In the long term, visual quality objectives would be met, the characteristic landscape would be enhanced, and the quality of the recreation experience would improve.

Approximately 108,120 acres of National Forest System lands in the project area would be subject to broadcast burning treatments. There would be short- and long-term direct and indirect major adverse impacts from blackened trunks and burn scars on leave trees. These would introduce dark, contrasting colors into the landscape that can last 10 to 15 years. However, understory vegetation is expected to fill in and help blend the dark colors into the landscape over time. Dead and dying woody vegetation from low-intensity burning would be a long-term impact, as it typically takes 3 to 5 years to recover. However, herbaceous vegetation would recover more quickly, typically within one growing season. Low-intensity smoke causes a temporary lack of visibility and obscures scenery. This type of smoke only occurs only for the duration of the burn and dissipates into the atmosphere, as opposed to smoke from an uncharacteristic wildfire, which can heavily impact air quality and landscape visibility for weeks or months.

The landscape character would be adversely altered because prescribed fire temporarily introduces areas of dark color into the landscape via tree scorch, burnt soil, and blackened understory. The loss of vegetation would also adversely impact the landscape character. This typically lasts 2 to 5 years, resulting in short- and long-term impacts. Scenic benefits and visitor experiences would be diminished in the short term in the areas of treatment. The scenic integrity would be adversely affected; the visual quality objective class of Retain would be altered and exceeded because of the visual contrasts created in line, form, color, and texture.

In the long term, broadcast burning treatments have the potential to have beneficial impacts and improve scenery resources and therefore the characteristic landscape. The removal of fire ladders and ground fuels not only reduces risks from wildfires but also helps to produce the conditions that people find attractive, such as open, park-like conditions. By improving forest conditions to accommodate low or moderate fires, the risk of stand-replacing fires is lowered. Light surface burns may have no long-term visual impact on the landscape, whereas high-intensity stand-replacing wildfires have long-term visual impacts. Ecologically, the treatments would increase the landscape's resilience to wildfire, disease, and drought and would ensure that the scenic integrity would be preserved and visual quality objectives would be met.

Herbicide applications would have different visual impacts, depending on the context of the application. Short-term direct visual impacts in the form of contrasts to texture and color could be created from the dead and dying vegetation. Impacts similar to vegetation thinning could occur if vegetation is removed after the applications. However, as with all the proposed treatments, the long-term impacts would be beneficial because native vegetation would have the opportunity to reestablish in treated areas and there would be a shift to a healthier more resilient ecosystem.

The resource protection measures set forth in Chapter 2 (Section 2.2.5) are designed to minimize, avoid, or mitigate adverse effects that could occur as a result of implementing proposed treatments for the project. Regardless, implementation of the proposed action is expected to temporarily drop the scenic quality and violate the visual quality objectives, especially in retention areas while the landscape transitions toward the desired landscape character conditions (Table 3-46). Drops in scenic quality are expected to occur during and immediately following implementation when the rate of visual change is most dramatic. The reduction is expected to taper off over the first 5 years as scenic integrity is restored.

Table 3-46. Resource Indicators and Measures for Alternative 2 Direct/Indirect Effects

Resource Element	Resource Indicator (quantify if possible)	Measure (quantify if possible)	Alternative 2 Direct/Indirect Effects
Characteristic Landscape	Enhancement of existing landscape character achieved	Changes in scenic attractiveness	Short-term direct and indirect impacts would drastically alter the landscape character because of tree removal, soil and vegetation scorching, and dead and drying vegetation. Long-term direct and indirect effects would enhance the landscape character as more open space would be created and vegetation would be healthier.
Visual Quality Objectives	Determine whether areas of Retain or Partial Retain classes would be significantly or irreversibly altered. *Note there are no Very High (Preserve) acres in the project area.*	Degree of contrast in line, form, color, and texture	Short- and long-term violation of visual quality objectives in both classes from moderate and strong contrasts in line, form, color, and texture.
Scenic Benefits	Quality of life and recreation experience	Qualitative discussion about the adverse and beneficial effects of the proposed project on public perception	Short-term direct and indirect impacts would degrade the quality of life and recreation experience because of tree removal, soil and vegetation scorching, and dead and drying vegetation. In the long term, the quality of life and recreation experience would be enhanced as more open space would be created and vegetation would be healthier.

Cumulative Effects

See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on scenery and visual quality.

The cumulative effects analysis for Alternative 2 includes projects located within the 10-mile buffer surrounding the project area occurring within the past decade and future decade. The area was chosen because this is the approximate distance from where other projects, including the South Sacramento Restoration Project, could be seen.

Past and present actions that would add to the cumulative impacts for visual resources include restoration and fuels reduction projects, range and wildlife improvement projects, and wildland fire management (see Table 3-1). All of these actions would create surface disturbance or visual contrasts on the landscape that would have an impact on visual resources.

Cumulative impacts would be most visible from highly used roads and trails and superior viewpoints, such as high-elevation areas or summits. Taken together, these activities would have adverse impacts to the characteristic landscape, would violate Retain and Partial Retain classes of visual objectives when they occur within the project area, and would not offer scenic benefits. However, projects within the project area and in the analysis area would offer long-term benefits to scenery by enhancing the characteristic landscape, retaining the visual quality objectives, and providing scenic benefits.

3.8.4 Forest Plan Amendments

Under the current Forest Plan, most of the restoration treatments would violate visual quality objectives in Retain and Partial Retain classes in the short term, over the duration of the project. However, as part of the proposed action, a Forest Plan amendment is proposed as follows: “The South Sacramento Restoration Project area is exempted from meeting retention and partial-retention [visual quality objectives] VQOs until slash disposal treatments and rehabilitation of landings, skid trails, and temporary roads are completed." The proposed amendment would allow for individual forest restoration treatments to be implemented over a longer duration without violating the visual quality objectives for the project. This would have major beneficial impacts in the long term for visual resources as the project's desired conditions—increased diversity of age-class, species, and spatial distribution in the forests; increased diversity of sizes of tree groups and openings between groups of trees; increased areas of open canopy cover to reestablish scenic views; and restored and maintained waterways and meadows—would enhance the landscape character.

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to scenery resources from the no action alternative and proposed action. The proposed action would result in short-term adverse impacts due to treatments, but long-term enhancement of landscape character and visual quality due to the creation of open spaces and enhanced views.

3.9 Recreation, Infrastructure, and Inventoried Roadless Areas

The recreation, infrastructure and inventoried roadless areas specialist report (U.S. Forest Service 2018h) is incorporated by reference. See the report for detailed information about data sources, methodology, assumptions, and limitations.

3.9.1 Affected Environment

Recreation Settings

This area of Lincoln National Forest is known for its large-scale, undeveloped areas and remoteness, which provide a wide variety of recreational opportunities for users who wish to experience undeveloped recreation, as well as those seeking more organized or packaged recreation experiences.

Recreational opportunities and activities in the project area are managed by the Forest Service in accordance with prescribed settings. Lincoln National Forest has finalized prescribed recreation settings for the upcoming Forest Plan Revision (U.S. Forest Service 2016d). Integral to both prior and current recreation planning processes is the use of a tool called the recreation opportunity spectrum (ROS). This is a system used to inventory and classify public lands according to physical, social, and managerial settings, which combine to offer specific types of recreational opportunities. As the name implies, such settings range across a spectrum of opportunities from primitive, where motorized use does not occur and facilities are non-existent or minor in extent, to urban, where opportunities are vehicle dependent and facilities may be extensive. Forest Service Manual 2300 applies to recreation management.

Critical to producing recreation opportunities is the condition of recreation settings on which those opportunities depend. The recreation opportunity spectrum uses settings that correspond to allowable uses. The recreation opportunity spectrum stratifies and defines classes of outdoor recreation environments. The spectrum may be applied to all lands, regardless of ownership or jurisdiction.
The recreation opportunity spectrum divides recreation settings into six broad categories: urban, rural, roaded natural, semi-primitive motorized, semi-primitive non-motorized, and primitive (U.S. Forest Service 1986c). The project area consists of rural, roaded natural, semi-primitive motorized, and semi-primitive non-motorized classifications, as shown in Table 3-47.

Table 3-47. Recreation Opportunity Spectrum Classification of the Project Area

Recreation Opportunity Spectrum Classification	Acres in Project Area
Rural	1,784
Roaded-Natural	62,052
Semi-Primitive Motorized	24,286
Semi-Primitive Non-Motorized	53,829

Note: Total recreation opportunity spectrum acreage does not correspond to total project area acreage because some areas of the project area have not been assigned a recreation opportunity spectrum classification.

Recreation opportunity spectrum settings take into account characteristics related to an area's remoteness, natural setting, evidence of human influence, facilities available, types of uses allowed, and potential levels of human interaction. Criteria used to evaluate these settings are available in the recreation, infrastructure, and inventoried roadless areas specialist report (U.S. Forest Service 2018h). Rural recreation opportunity spectrum classification areas within the project area generally correspond to developed areas, largely confined to corridors along primary routes or highways, as well as the Sunspot Observatory area. The roaded-natural classifications within the project area typically correspond to the route network, which also generally corresponds to the low canyons and follows surface water drainages. The semi-primitive motorized and semi-primitive non-motorized classifications generally correspond to the uplands in the project area (i.e., hillsides and mountains). Figure 3-39 illustrates the recreation opportunity spectrum classifications in the project area.

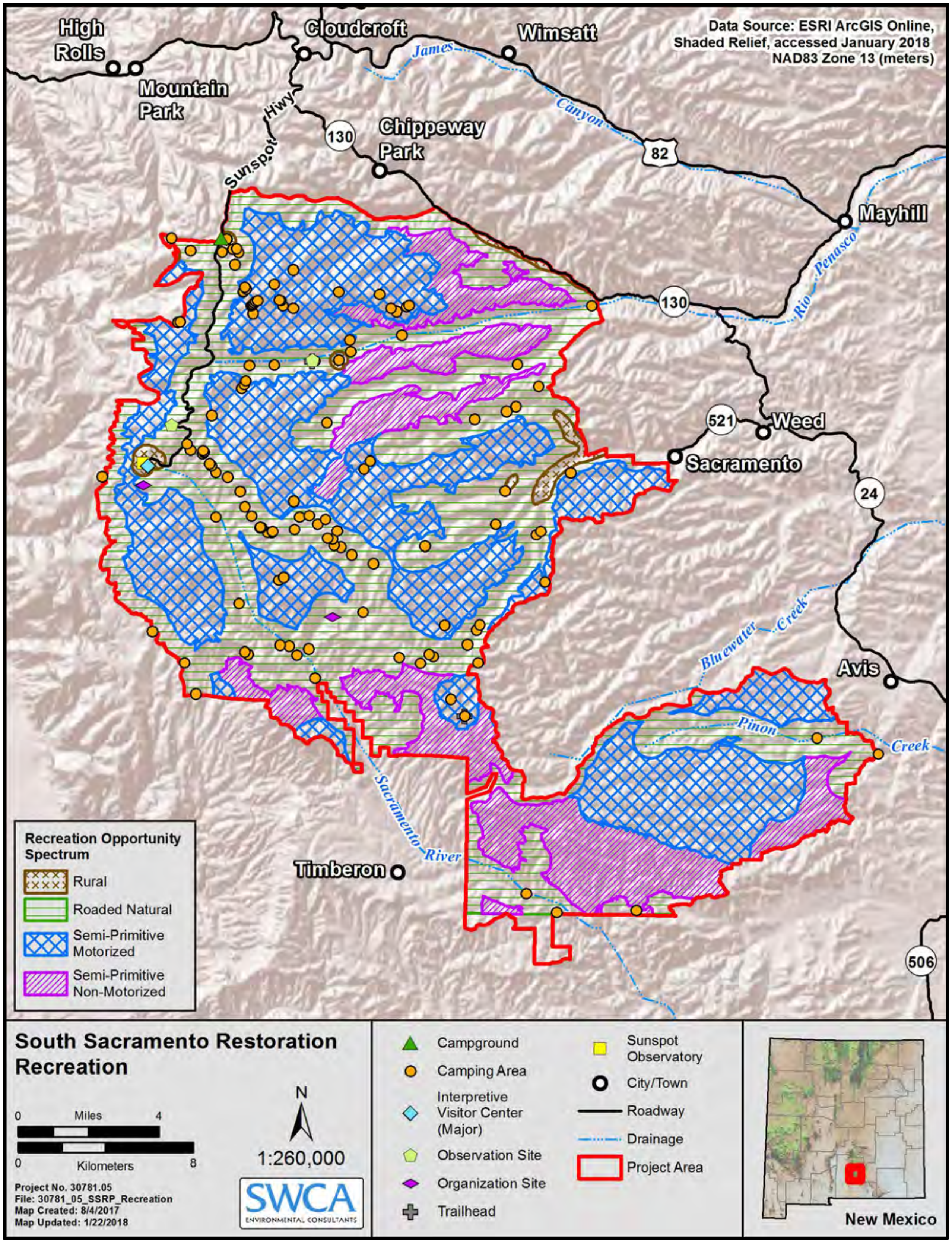

Figure 3-39. South Sacramento Restoration Project Area recreation overview.

Recreation Opportunities/Activities

Recreation opportunities and activities occurring throughout the project area involve a broad spectrum of pursuits, ranging from dispersed and casual recreation to organized, Forest Service–permitted group uses. Typical recreation in the project area includes, but may not be limited to,scenic viewing, off-highway vehicle driving, scenic driving, hunting, hiking, wildlife viewing, horseback riding, camping, backpacking, winter sports (downhill and cross-country skiing and snowmobiling, snowshoeing), cycling, mountain biking, geocaching, rock-hounding, picnicking, night-sky viewing, viewing cultural/historical sites, and photography. The Forest Service provides direction on which activities are allowed in certain areas and which activities may not be allowed. Current recreation use of the Lincoln National Forest is highest in the “General Forest Area” (i.e., dispersed recreation), followed by “Day Use” (i.e., a single day), “Overnight Use” (i.e., camping), and finally, “Wilderness” (note: there are no designated wilderness areas in the project area) (U.S. Forest Service 2017h).

Seasonal weather changes both prevent and allow certain recreation opportunities to be pursued, such as when the project area is blanketed in snow during the winter months. Table 3-48 provides the various recreation opportunities that are present in the project area (this list is not exhaustive). Figure 3-39 above illustrates the location of certain recreation opportunities.

Table 3-48. Recreation Opportunities in the Project Area

Recreation Opportunity	Amount Available
Campground, Developed	1
Camping Area, Dispersed	124
Interpretive Visitor Center	1
Observation Site	1
Organization Site	1
Trailheads	2
Number of Trails	45
Miles of Trails	108 miles
Concentrated Use Areas	6
Miles of Concentrated Use Areas	85 miles

Concentrated use areas in the project area are all driving-for-pleasure loop routes. These loops offer motorists outstanding opportunities for scenic viewing, and represent a popular recreation opportunity within the project area. Table 3-49 lists the concentrated use areas that occur within the project area.

Table 3-49. Concentrated Use Areas within the Project Area

Concentrated Use Area Name	Total Length
Bear Canyon Loop	17 miles
Bluewater Loop	11 miles
Cloudcroft Loop	10 miles
Monument Loop	15 miles
Sunspot Loop	21 miles
West Side Loop	11 miles

Hunting

Land within the project area is open to hunting if the user possesses an active individual permit (e.g., a valid New Mexico hunting license), unless otherwise specified. The entire project area is within Game Management Unit 34. Game Management Unit 34 offers a wide variety of hunting opportunities; however, big-game hunting is the most popular and most pursued in the project area (elk, bear, cougar, deer, and barbary sheep) (New Mexico Department of Game and Fish 2014).

Hunting is permitted year-round, during specified seasons for specific species; most hunting occurs in the late summer and fall. Hunting is pursued by local Otero County residents, New Mexico residents, out-of-state residents, and even hunters coming from different countries.

Desired Recreation Experiences

The Lincoln National Forest Plan does not include "Desired Condition" sections for recreation. However, the objectives for recreation (for all management areas of the Lincoln National Forest) do specify the following:

- Manage for a variety of developed and dispersed recreation experiences while maintaining the current spectrum of opportunities. Encourage opportunity for private sector to meet part of recreation demand. Provide a system of roads and trails for motorized recreation use while protecting other resources.
- Preserve and protect cave resources to provide a wild caving experience and to provide quality information and interpretive services related to this unique resource.
- Coordinate with the New Mexico Natural Resources Department to contribute to goals and objectives specified in the State Comprehensive Outdoor Recreation Plan.

Infrastructure

Transportation System

Forest Service Manual 7730 and Chapter 60 of the Forest Service Handbook 7709.59 apply to maintenance of National Forest System roads and trails. Forest Service Manual 7730.2 states, "Operate and maintain NFS roads in a manner that meets road management objectives (RMOs) and that provides for:

1. Safe and efficient travel;
2. Access for the administration, use, and protection of NFS lands; and
3. Protection of the environment, adjacent resources, and public investment."

The U.S. Forest Service classifies maintenance of National Forest System roads by five levels: 1, 2, 3, 4, and 5. Maintenance Level 1 roads are closed to motorized vehicle use. Maintenance Level 2 roads are maintained for high-clearance vehicles, and Maintenance Level 3, 4, and 5 roads are maintained for standard passenger cars during the normal season of use.

In 2008, Lincoln National Forest reviewed the 1986 Forest Plan route data as mandated by the 2005 Travel Management Rule. In 2009, Lincoln National Forest issued a decision notice that the existing management plan (including route density) met all of the Travel Management Rule guidelines and that existing management would continue. The results informed the creation of the current Motor Vehicle Use Map (U.S. Forest Service 2017i).

The project area contains all types of National Forest System routes. This analysis focuses on the Sacramento Ranger District's "core" routes and Motor Vehicle Use Map routes. There are approximately 360 miles of core routes (core routes indicate that the route is open for public use) in the project area and approximately 168 miles of Motor Vehicle Use Map routes in the project area. Figure 3-40 illustrates the Motor Vehicle Use Map roads within the project area.

Other Infrastructure

As specified in the Forest Plan, the Forest Service has included a standard and guideline for "Facilities," which for the purposes of this analysis is categorized as "other infrastructure:"

- Provide administrative improvements to meet resource and management needs.

Lincoln National Forest maintains a "constructed features" data set; the constructed features that occur within the project area are provided in Table 3-50. The "housing" feature type includes housing structures that are located on land-locked private parcels, as well as those that occur upon the Lincoln National Forest.

Table 3-50. Existing Constructed Features within the Project Area

Feature Type	Number of Features
Bridge	1
Corral	15
Distribution Pipeline	1
Fence-Bridge	1
Helipad	1
Housing	311
Radio Tower	2
Repeater	2
Spring, Well Development	28
Spring, Metal Trough	1
Spring, Wood Trough	1
Water Storage Tank	78
Water Trough	6
Well, Windmill Steel Tower	1

Figure 3-40 below also illustrates the existing constructed features present within the analysis area. As shown in Figure 3-40, the majority of other infrastructure within the project area occurs along roads.

The Lincoln Forest Plan provides standards and guidelines that allow the Forest Service to grant rights-of-way to private and commercial interests:

- Authorize, by means of permit, use of National Forest System land by private or commercial interests when private land is not available and the requested use is compatible with other resources and activities.

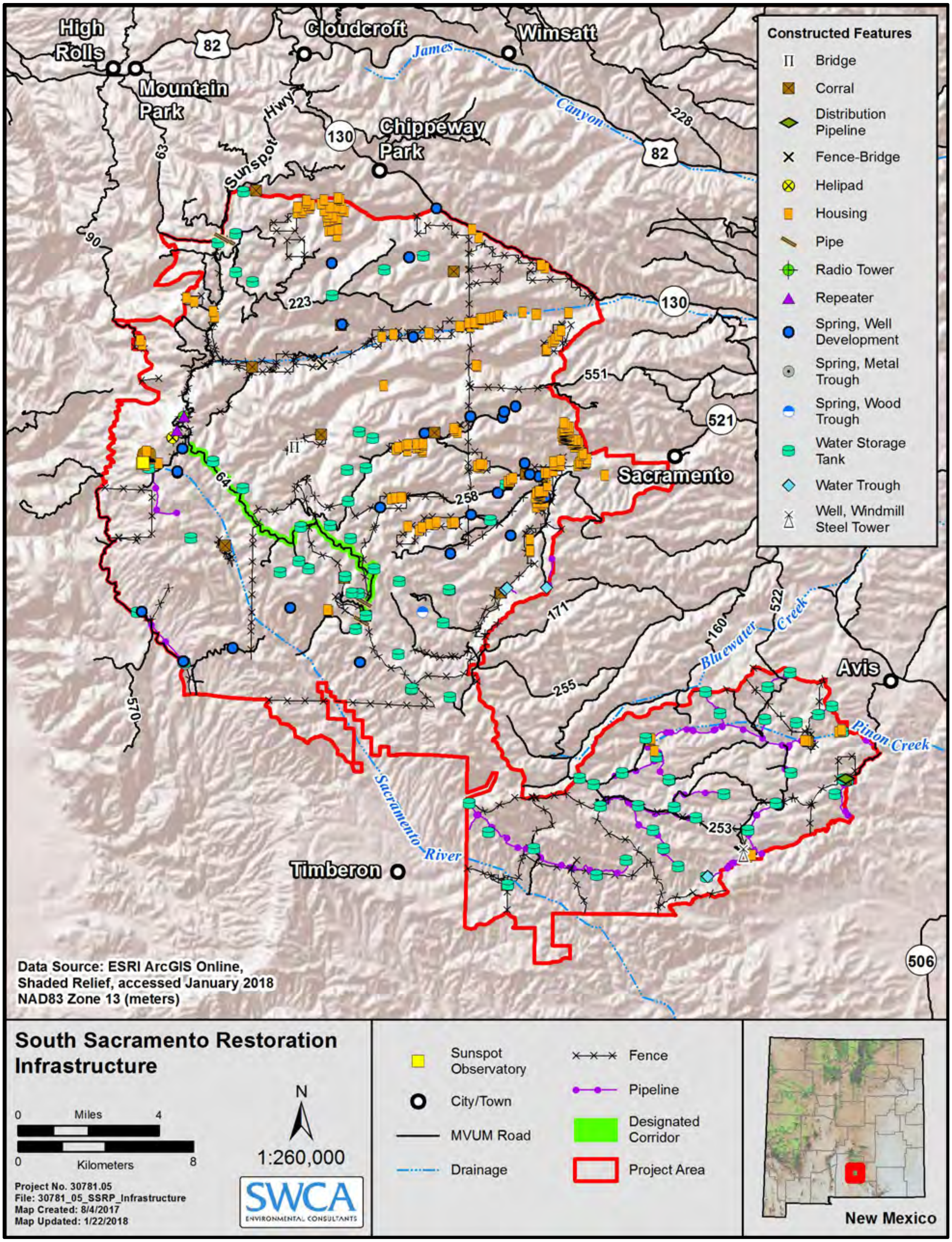

Figure 3-40. South Sacramento Restoration Project Area infrastructure overview.

There is one designated utility corridor within the project area: Route of National Forest System Road 64 (see Figure 3-40 above). Table 3-51 provides a breakdown of the linear features that occur within the project area.

Table 3-51. Existing Linear Features within the Project Area

Feature Type	Total Length
Utility Corridor	11 miles
Pipelines	39 miles
Power lines	unavailable
Fence	190 miles

Inventoried Roadless Areas

Inventoried roadless areas are areas designated to conserve lands with the following characteristics:

- Natural, being substantially free from the effect of modern civilization
- Undeveloped, having little or no permanent improvements or human habitation
- Outstanding opportunities for solitude or primitive and unconfined recreation
- Special features and values, or the potential to contribute to unique fish, wildlife, and plant species and communities; outstanding landscape features; and significant cultural resource sites
- Manageability, meaning that the area is at least 5,000 acres in size

The project area contains one inventoried roadless area: Jefferies Canyon, located in the south-central portion of the project area (Figure 3-41). The inventoried roadless area consists of rough terrain with elevation ranging from 6,400 to 8,200 feet. Jefferies Canyon Inventoried Roadless Area is approximately 8,863 acres.

There are no designated trails within the inventoried roadless area. Dispersed recreation (hiking, backpacking, hunting) is conducted via cross-country foot or horse travel. Public use of the inventoried roadless area is considered moderate; it is mostly busy during the big-game hunting seasons.

As illustrated in Figure 3-41, an existing route that is open to public use (National Forest System Road 5549) does occur within the inventoried roadless area; this route is approximately 2 miles long and requires high-clearance vehicles.

3.9.2 Methodology and Assumptions Used for Analysis

The analysis to determine potential impacts to recreation, infrastructure, and inventoried roadless areas is based on existing management and data from Lincoln National Forest and State resource management. Spatial/geographic information system data were also used in this analysis and include recreation settings, designated recreation sites, existing infrastructure and route inventory, and inventoried roadless areas.

The spatial boundary for analyzing the direct and indirect effects on recreation, infrastructure, and inventoried roadless areas is the project area, because this is the area in which the South Sacramento Restoration Project would be implemented. Because the proposed project could affect recreation conditions and recreation use may intensify and vary widely, the entire project area is considered, even if there are never any restoration treatments implemented for a specific area of the project area.

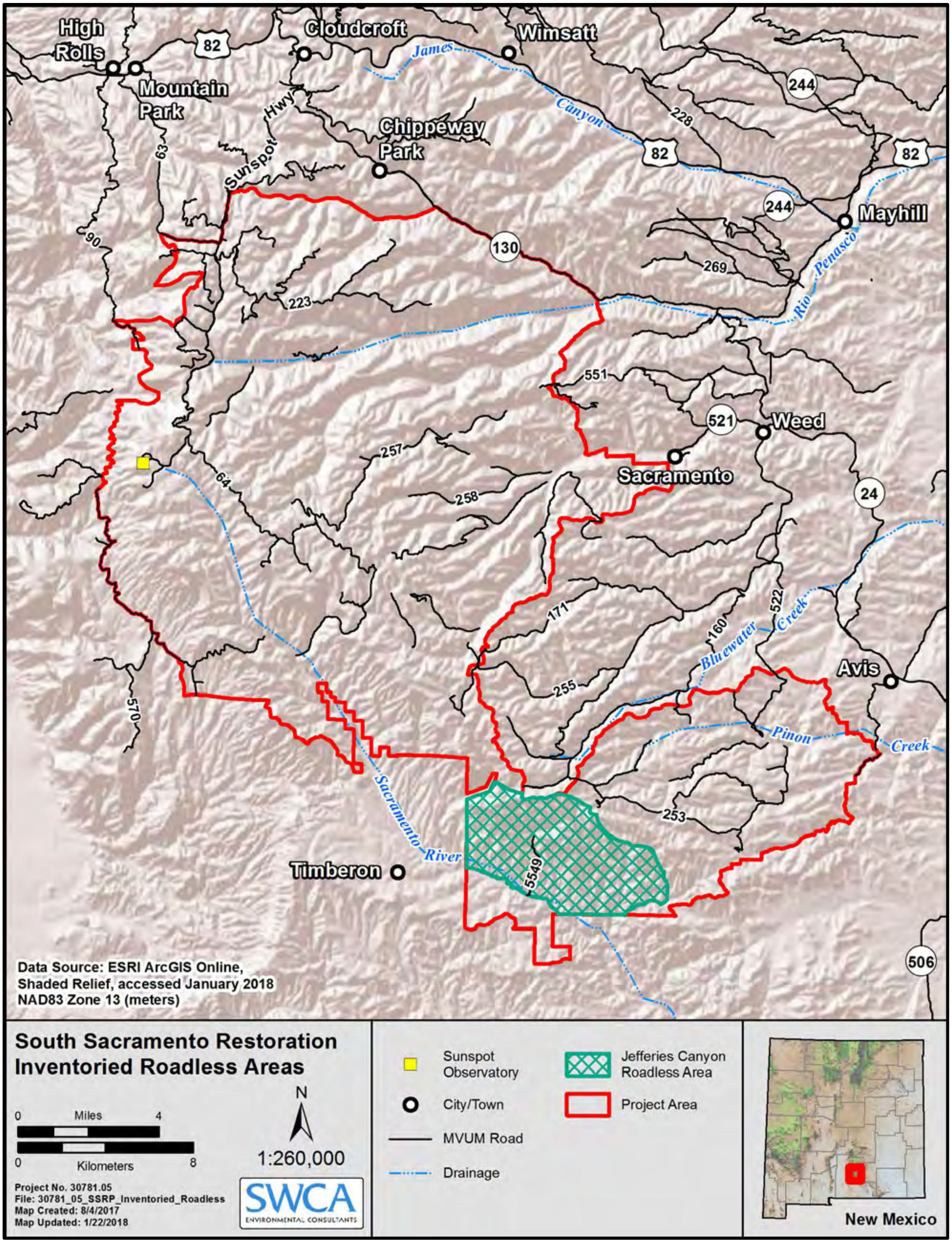

Figure 3-41. South Sacramento Restoration Project Area inventoried roadless areas overview.

The temporal boundaries for analyzing the direct and indirect effects are 1 to 2 years for short-term impacts and 2 to 20 years for long-term impacts. The proposed project is expected to last approximately 20 years. Ongoing maintenance could occur beyond 20 years (e.g., in perpetuity) but would occur at reduced degrees.

Table 3-52 provides a breakdown of the indicators and measures used in the analysis. The changes to the resource condition indicators provide the basis for assessing impacts.

Table 3-52. Resource Indicators and Measures for Assessing Effects

Resource Element	Resource Indicator	Measure (quantify if possible)	Used to Address Purpose and Need or Key Issue?
Recreation Setting	Changes to the existing recreation setting	Qualitative assessment of restoration within recreation opportunity spectrum classes	No
Recreation Opportunities	Changes (loss of or creation of) to the current available recreation opportunities and activities	Qualitative assessment of restoration method's impact to recreation opportunity	No
Desired Recreation Experiences	Changes (diminishment or improvement) to existing recreation values and quality	Qualitative assessment of restoration method's impact to recreation desired experiences	No
Infrastructure	Restoration methods that result in changes to existing infrastructure	Qualitative assessment based on restoration activities	No
Infrastructure	Changes to existing traffic patterns	Acres of restoration intersecting with infrastructure	No
Inventoried Roadless Areas	New access roads constructed within inventoried roadless areas	Miles of access roads within the inventoried roadless area	No
Inventoried Roadless Areas	Changes to the naturalness, undeveloped character, opportunities for solitude, and reduction in size	Qualitative assessment of restoration method's impact to roadless characteristics.	No

3.9.3 Environmental Consequences

Alternative 1 – No Action

Recreation Setting, Opportunity, and Experience

There would be no impacts to the existing recreation setting, opportunity, and existing recreation experiences beyond those that are already occurring in the project area. Under the no action alternative, these impacts are expected to occur at similar frequencies and intensities as they do today.

Currently, the Forest Service has limited resources to maintain existing recreation opportunities (e.g., clearing down trees from trails and roads) or to mitigate threats such as the impacts to recreation facilities such as campgrounds, trailheads, roads, and parking areas that could result from a wildfire, windthrow, or other disturbance. Current maintenance is limited to removing existing vegetation threats as time and resources are available and depending on the risk to health and human safety, as opposed to maximizing resources by treating larger areas to restore forest resiliency, as proposed in Alternative 2. Piecemeal treatments that only address immediate hazards would not reduce the risk for large catastrophic wildfires, and often do not address recreation site hazards such as dead and dying trees that block safe passage on forest roads and trails. The threat of uncharacteristically severe wildfire, windthrow, or other disturbance would continue to increase with ongoing, non-landscape-scale vegetation management activities under Alternative 1. Furthermore, continuing to only remove site-specific vegetation as time and resources permit will perpetuate current unhealthy forest conditions and could even increase the rate of forest health decline.

Research and recent wildfires in New Mexico have demonstrated the negative effects severe wildfire can have on recreation (such as the June 2012 Little Bear Fire on the Lincoln National Forest, where fire impacts included closing developed campgrounds and trails to public use and created safety hazards to dispersed recreation opportunities such as camping and hunting). If the South Sacramento Restoration Project analysis area or portions thereof were closed due to wildfire, recreation users would be required to seek alternative locations to pursue the same activity. This could lead to overcrowding in nearby areas of Lincoln National Forest, resulting in potential resource damage and undesirable recreational experiences.

Barring a severe wildfire, windthrow, or other disturbances, there would be no loss or creation of recreation opportunity. Hunting opportunities would continue, in accordance with current New Mexico Department of Game and Fish regulations. Recreation opportunities and activities would continue as they do today, and the quality of the recreation experiences, as well as the desired recreation experiences as outlined in the Forest Plan, would be expected to remain.

Infrastructure

Transportation System

Current practices for vegetation thinning, prescribed fire, herbicide, or watershed improvement treatments would not change under the no action alternative. Motorists traveling on the 360 miles of core routes and 168 miles of Motor Vehicle Use Map National Forest System routes designated open to public use could experience direct and indirect effects (described below) from road closures and/or temporary traffic delays. The current practices for vegetation thinning, prescribed fire, herbicide, or watershed improvement treatments would continue to be in compliance with travel management prescriptions. Public access to private inholdings and grazing allotments, as well as access to recreation sites, hunting areas, and firewood collection areas would also result in direct and indirect effects where immediate safety risks resulting from current treatments are found or when existing routes need repair work. These effects occur intermittently across the project area and would continue to be temporary and short term.

Other Infrastructure

Constructed features (e.g., recreation/interpretive sites, structural grazing/range improvements, and wildlife/livestock water developments), utility corridors, and rights-of-way would not change under the no action alternative. All current activities would preclude existing constructed features, utility corridors, and rights-of-way, except where guided by a separate decision and supporting analysis. The Forest Service would continue to assess current restoration implementation’s potential impact to constructed features, utility corridors, and rights-of-way on a case-by-case basis (i.e., not landscape scale or a toolbox approach). This would have the possible indirect effect of not reducing the potential and risk for wildfire, which is one of the primary purposes of and need for the project. Constructed features, utility corridors, and rights-of-way may continue to be at high wildfire risk.

Inventoried Roadless Areas

Current practices for vegetation thinning, prescribed fire, herbicide, or watershed improvement treatments within the Jefferies Canyon Inventoried Roadless Area would not change under the no action alternative, so there would be no direct impacts. Fuel loading may increase and the risk of wildfire would correspondingly also increase both within and adjacent to the inventoried roadless area.

No plan amendments are included under the no action alternative.

Alternative 2 – Proposed Action

Under the proposed action, the U.S. Forest Service proposes to conduct forest restoration activities on approximately 140,000 acres in the southern Sacramento Mountains over the next 10 to 20 years to meet initial project objectives, with additional maintenance treatments beyond 20 years. Restoration activities would occur in all ecosystems in the area, including mixed-conifer forests, ponderosa pine, pinyon-juniper, riparian areas, meadows, and aspen habitat types. Restoration activities would focus on thinning and burning treatments to improve forest health and resiliency by reducing stand density, continuity, and homogeneity (sameness of forest structure and species composition), and increasing heterogeneity (diverse forest structure and species composition) at a landscape scale, mid-scale, and fine scale.

The proposed action includes a range of treatments for a variety of vegetation types. The main treatments proposed are mechanical treatments and prescribed fire. Areas receiving mechanical treatments would also be followed by prescribed fire. Associated staging areas and temporary access roads could also be included, depending upon the site-specific conditions and targeted purpose of the restoration method.

Direct and Indirect Effects

Recreation Setting, Opportunity, and Experience

As described in Chapter 2, some recreation and/or interpretive sites would be targeted for restoration. Dispersed and established recreation sites would be rehabilitated as needed by replanting native woody vegetation or reseeding using native grasses and forbs. Soil or rock may be spread on-site if erosion problems are severe. Boulders, logs, or similar materials may be temporarily placed as needed to protect newly planted vegetation. This could cause temporary (e.g., a single season), minor to moderate impacts to site-specific recreation sites. Noise from restoration activities and views of workers, equipment, vehicles, or debris and cleared areas could temporarily and adversely impact the experience of recreationists in developed as well as dispersed settings (particularly those settings classified under the recreation opportunity spectrum as semi-primitive motorized and semi-primitive non-motorized, where such activities would be more evident and expected to be encountered less), including driving for pleasure on routes and hiking/biking on trails. These indirect effects would be temporary and localized, as the recreationist moves past the work area (or vice versa). Noise and visual changes would be more noticeable to recreationists in semi-primitive motorized and semi-primitive non-motorized settings because these areas are less developed, with fewer opportunities of encountering the sights and sounds of restoration activities and other recreationists. Maintaining vegetation clearances or establishing new forest health at recreation sites and around infrastructure may result in changes to the recreation setting, but these changes would be intended to benefit the recreation setting in the long-term.

However, the restoration would be conducted in a manner that would not preclude entire recreation settings available for public use (e.g., degraded sites would be restored sequentially in order to not completely eliminate the resource in the project area). Upon restoration, the recreation setting or interpretive site would likely improve (e.g., become safer, more scenic, and more sustainable for future recreationists), resulting in a long-term, beneficial impact. Similarly, an indirect impact of reconstructing or rehabilitating routes would result in long-term, beneficial impacts to the recreation setting and experience.

Restoration activities conducted in areas that are not near developed sites or adjacent to routes or trails (i.e., in semi-primitive non-motorized areas) under the proposed action, though primarily intended to restore overall forest health, watershed health, and wildlife habitat for each ecological response unit, would have beneficial effects on the recreation setting. A healthier forest (i.e., mixed conifer, ponderosa pine, and pinyon-juniper woodlands and grass, with natural plant and animal demographics, maximum structural and spatial heterogeneity of vegetation, maximum productivity and biodiversity, and intact ecosystem processes and functions) would be more open in character than the current landscape and would offer more dispersed recreation opportunities like hunting, hiking, and wildlife viewing.

Current recreation opportunity spectrum settings would not change under the proposed action, and all restoration activities would be conducted such that the proposed action would conform to the recreation opportunity spectrum classifications delineated in the Forest Plan.

Recreation Opportunities/Activities

Restoration activities, particularly those that involve heavy equipment or machinery, have the potential to adversely impact recreation opportunities and experiences; these impacts would be site specific and short term. The resource protection measures included under the proposed action would limit the impacts when practical to non-peak seasons, when recreation use is anticipated to be at its lowest.

Camping primarily occurs along designated roads and trails. Campsites, both developed and dispersed, could be temporarily closed or restricted for public safety, including prescribed burning, heavy equipment use, slash piles, and even hand vegetation thinning. Campers in dispersed sites while work is underway would experience indirect noise and visual effects similar to those already described.

Concentrated use areas would not be impacted by restoration activities beyond the indirect, minor impacts of smoke from prescribed fires; these instances would be communicated to the public to the degree possible, enabling motorists to avoid smoky areas.

Hunting

Hunting opportunities (both big and small game) that could be displaced by restoration activities would have minor to moderate impacts, since the areas within the game management unit that are beyond a given restoration activity would remain available for hunting, subject to applicable laws and regulations.

As stated in the Resource Protection Measures (Public-2), the Lincoln National Forest would communicate any potential closures to hunting areas well in advance of hunting seasons, in coordination with the New Mexico Department of Game and Fish. Efforts to avoid closing areas during big-game hunting seasons, where feasible, would be prioritized, in coordination with the New Mexico Department of Game and Fish, as appropriate. The Lincoln National Forest would post signs in accordance with the laws and regulations for hunting to indicate areas that would be closed to hunting during restoration activities. For hunting seasons that occur year-round or restoration activities that cannot be sequenced to avoid hunting seasons, hunting with a firearm for those species would be precluded in site-specific, localized areas since the laws and regulations for the manner and method of taking wildlife would make it illegal to discharge firearms near the restoration activities.

In addition, human presence and restoration activities may cause some game species to temporarily avoid these areas; therefore, even if hunting were not precluded, hunting opportunities may decrease during restoration as a result of increased noise and human activity. Following restoration activities, game species are expected to reenter treated areas because noise and human activities would no longer be a deterrent, and the impacts to hunting would cease. Therefore, potential impacts to hunting opportunities in site-specific areas during restoration activities would represent a temporary, minor impact. Restoration activities would be designed/sequenced as such to not persist in any given area for an entire hunting season, where feasible. The number of hunting permits that are issued in Game Management Unit 34 would not change as a result of the project. The availability to legally hunt in Game Management Unit 34 and the number of hunting permits would not change as a result of the project since restoration activities would never cover 100 percent of Game Management Unit 34. Further, hunter-days would not change under the proposed action, since hunting could persist elsewhere in the game management unit.

If restoration sequencing to avoid hunting seasons is not attainable in some instances, there could be site-specific, localized, moderate impacts to individual hunters during restoration activities if their preferred access is temporarily closed or restricted. This impact would not extend to hunting overall, but could represent an obstacle to an individual hunter’s preferred access to a particular area. Coordination with the New Mexico Department of Game and Fish would be undertaken in an attempt to avoid and minimize these impacts.

Desired Recreation Experiences

The desired recreation experiences of the project area would not change since the restoration methods would be conducted so that they minimize impacts to recreation experiences and in compliance with the Forest Plan. Restoration methods would only preclude recreational desired experiences temporarily during surface-disturbing restoration work; once activities are completed, the desired recreation experiences would continue, subject to public safety concerns.

Infrastructure

Transportation System

As described in the proposed action, road construction, reconstruction, maintenance, and rehabilitation would be needed throughout the project area to support the proposed restoration treatments. Approximately 240 miles of existing and new National Forest System roads would be used to complete the proposed activities, and up to 125 miles of temporary and system roads would be constructed to support implementation of the proposed action. All road construction would be implemented in a manner that would be compliant with the Forest Plan and the Travel Management Rule. New road construction and existing road reconstruction, maintenance, or rehabilitation would be a minor, localized impact to the existing transportation system. Temporary new roads would have short-term impacts to the transportation system, while permanent new roads would have long-term impacts to the transportation system. All restoration activities that would involve vehicle use and/or access roads would be in compliance with travel management prescriptions and would employ best management practices that are intended to have minimal impacts to the existing route system.

The impacts of the use of existing roads and new road construction would be spread out over the 20- year period and would not occur all at once. An indirect impact of new roads, whether temporary or permanent, could be the potential for user-created routes and illegal use. U.S. Forest Service signage, as well as best practices by contractors, would minimize the potential for illegal use.

Some open system roads could be temporarily closed to the public during project implementation operations for public safety. The Lincoln National Forest would coordinate any closures with local agencies, landowners, or permittees that could be affected by temporary road closures to limit impacts to the greatest possible extent. Temporary road closures would occur in site-specific areas of the existing core road system and 168 miles of Motor Vehicle Use Map road systems, resulting in minor impacts to public access.

Depending upon the restoration method and the site-specific conditions of existing traffic, equipment and workers may require use of existing routes. Also, some methods may require temporary road closures, escorts, lane closures, or reroutes, which would change traffic patterns. This includes rehabilitation or maintenance of routes. Hauling equipment, heavy machinery, and increased use may damage roads by creating holes, washboards, or ruts. Rehabilitation or maintenance of existing routes would ensure that routes remain open for the level of motorized use designated on the Motor Vehicle Use Map. This would result in minor, adverse, short-term impacts to motorists as well as the ability to access private inholdings and grazing allotments, recreation sites, interpretive sites, hunting areas, and firewood collection areas. These impacts would occur only when work is being conducted in the immediate area, on short sections or routes at a time. Traffic patterns would be restored once the restoration activity is complete. Indirect impacts could result from changing traffic patterns from motorists taking other routes or use of unauthorized routes.

Other Infrastructure

Constructed features (e.g., recreation/interpretive sites, structural grazing/range improvements, and wildlife/livestock water developments) would be avoided, removed and replaced, or restored following restoration activities. All proposed restoration activities would preclude existing constructed features, utility corridors, and rights-of-way, except where guided by a separate decision and supporting analysis. Therefore, potential impacts to constructed features in site-specific areas during restoration activities would represent a temporary, minor impact.

Inventoried Roadless Areas

There would be prescribed fire restoration activities within the Jefferies Canyon Inventoried Roadless Area. The restoration methods applied within the inventoried roadless area would use equipment and vehicles that that do not require the use access roads (e.g., vehicles capable of overland travel). As described in Chapter 2, restoration activities would focus on thinning and burning treatments to improve forest health and resiliency by reducing stand density, continuity, and homogeneity (sameness of forest structure and species composition), and increasing heterogeneity (diverse forest structure and species composition) at a landscape scale, mid-scale, and fine scale. Restoration methods would be limited to those that are compatible with forest plan direction for inventoried roadless areas, e.g., no new roads would be built, and no motorized vehicles or staging areas would be permitted in the roadless area. However, prescribed fire, and overland travel by vehicles that do not require new roads to be constructed for access (e.g., masticators) would be compatible restoration activities.

Since there would be no new roads or landings constructed within the inventoried roadless area,there would be no change in the roadless character. While forest restoration treatments with prescribed fire and overland travel treatments would be visibly and audibly discernible (i.e., smoke from prescribed fire or noise from equipment use) during and visibly after restoration operations, there would be no new permanent roads or authorized motorized access remaining after the project. The project would not forego any future management decisions for the inventoried roadless area. Minor, short-term, localized impacts would occur to the naturalness, undeveloped, and outstanding opportunities for solitude qualities of the inventoried roadless area from the presence of workers, smoke from prescribed burns and managing wildland fires, and noise from equipment.

Cumulative Effects

See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on recreation, infrastructure, and inventoried roadless areas.

The spatial boundaries for analyzing the cumulative effects on recreation resources, infrastructure, and inventoried roadless areas is the Sacramento Ranger District, as it represents a reasonable region in which recreation settings, existing recreation opportunities and activities, desired recreation experiences, infrastructure, and inventoried roadless areas, when assessed in combination with other cumulative actions, could be impacted if the proposed project were implemented.

The temporal boundaries for analyzing the cumulative effects is 30 years because restoration methods are anticipated to have taken effect in that time period.

The past uses in the cumulative effects analysis area have had a direct effect on the recreation settings, as described in Affected Environment and Environmental Consequences sections. Historic proliferation of mining and ranching roads, the establishment of federal, state, county, and private lands, and community development have all shaped the recreation opportunities, settings, and desired experiences in the cumulative effects analysis area.

Recreation

Nonnative, invasive plant management, watershed protection, fuels reduction, restoration, and habitat improvement activities all have the potential, when considered with the proposed action, to cumulatively impact the recreation setting. Ongoing activities such as the Westside Sacramento Restoration and Fuels Reduction Projects (6,848 acres), Jim Lewis Fuels Reduction Project (37,333 acres), Two Goats Restoration Project (5,346 acres), Rio Peñasco Project (4,347 acres), and Mescalero Apache Tribe Thinning and Burning Treatments (up to 2,500 acres per year) are similar in nature to the proposed action (but much smaller in scale, compared with the South Sacramento Restoration Project's 140,000 acres). The cumulative impact of the actions listed in Table 3-1 to the recreation setting would be adverse, minor, and short term. This is particularly true in areas classified as semi-primitive non-motorized because actively managed, intensive actions (as opposed to passive actions such as natural revegetation) like nonnative, invasive plant management, watershed protection, fuels reduction, restoration, and habitat improvements typically involve activities that are inconsistent with the objectives of a semi-primitive non-motorized area. While this impact may also occur in rural, roaded-natural, and semi-primitive motorized areas, actively managed, intensive actions are mostly consistent with these recreation opportunity spectrum classifications.

As described above under direct and indirect impacts, adverse impacts to recreation settings would be most apparent during and immediately after the action (e.g., prescribed burns may increase smoke in the surrounding areas but would cease once the material is burned up), since the implementation of actions listed in Table 3-1 and the proposed action would influence which recreation activities could safely occur and where (thus, influencing the existing recreation setting). As with the proposed action, the actions listed in Table 3-1 would be implemented over time, and therefore would not occur all at once over all the acreages included in Table 3-1. Users can be expected to pursue similar or other opportunities outside the South Sacramento Restoration Project treatment areas but within the cumulative effects analysis area. They can also be expected to return to the areas over time inside the South Sacramento Restoration Project area once restoration activities are successfully completed. Over time, the cumulative impacts to recreation setting would be reversed, and the recreation setting would be protected and enhanced by the South Sacramento Restoration Project.

Implementation activities of the proposed action and other reasonably foreseeable actions may detract from the recreational opportunities. For example, areas affected by controlled burns/fires derived from the actions provided in Table 3-1 would likely render the setting less desirable for recreation activities, thus affecting the recreation experience. These would be individually minor, but collectively moderate, particularly in areas where the proposed action and other reasonably foreseeable projects provided in Table 3-1 overlap and are not spread out over large areas. However, with the proposed action being staggered over long periods of time and the actions listed in Table 3-1 not all conducted concurrently, the cumulative effects on recreation opportunities and experiences would be substantially decreased (i.e., recreational opportunities would continue in areas not being actively restored). Therefore, recreational opportunities would not be lost permanently (i.e., restoration activities may only take a few days) and no recreational opportunities would be completely precluded, even during implementation of the proposed action or actions listed in Table 3-1 at any time since all recreation opportunities identified within the cumulative effects analysis area (including big-game hunting) are able to be pursued in adjacent and similar areas.

Off-highway vehicle riding may have more opportunities available as a result of the proposed action and other reasonably foreseeable projects provided in Table 3-1, particularly projects that create new access roads (both temporary and permanent), such as fuels reduction and forest restoration projects. These projects often encourage increased off-highway vehicle use through "curiosity," and users may use the access roads of the proposed action and other reasonably foreseeable projects' access roads to view the activities and/or sites (subject to existing New Mexico off-highway vehicle laws and regulations). New access roads used for restoration could provide additional avenues for riders to gain access to locations that were previously not accessible. There may be a need for additional enforcement and physical barriers to protect some areas to prohibit unauthorized off-highway vehicle access.

The desired recreation experiences of the project area would not change when considered in the context of the other actions listed in Table 3-1, since the Forest Service would ensure those projects would also be conducted in a manner that minimizes impacts to recreation experiences and in compliance with the Forest Plan.

Infrastructure

Some watershed protection, fuels reduction, restoration, and habitat improvement activities may require the construction of new temporary roads (e.g., Jim Lewis fuels reduction), similar to the proposed action. No other present or future actions that may change road density (i.e., new permanent road construction) are identified at this time by the Lincoln National Forest. An increase in temporary roads would be considered a short-term, minor cumulative impact.

Inventoried Roadless Areas

No new roads would be constructed in the inventoried roadless area, and none of the actions considered in Table 3-1 would construct new roads within the inventoried roadless area. Therefore, there would be no cumulative impacts to the Jefferies Canyon Inventoried Roadless Area.

3.9.4 Forest Plan Amendments

As described above under Regulatory Framework section, there are proposed plan amendments that would be anticipated to have impacts to recreation resources and the inventoried roadless area. The potential impacts to recreation and inventoried roadless areas would not be from the plan amendments themselves, but may result from specific activities in specific areas that would be allowed by Lincoln National Forest under the amendments.

There would be no impacts to infrastructure resources if the proposed plan amendments were implemented.

Under the proposed action there are three plan amendments that may impact the recreation setting, opportunities and experience, and inventoried roadless areas: 1) exempting the South Sacramento Restoration Project from meeting retention and partial-retention visual quality objectives; 2) the use of mechanized equipment on slopes greater than 40 percent (see the Regulatory Framework section above); and 3) expanding the ability to manage unplanned wildfires throughout the entire project area for multiple resource benefits. These proposed Forest Plan amendments are needed to achieve the purpose and need. These are site-specific amendments and would apply to the South Sacramento Restoration Project only. Impacts to recreation and infrastructure would be similar to those described above under the proposed action: potentially increased noise, traffic, and disturbance occurring during high recreation seasons (i.e., summer and fall); and increased smoke from prescribed and naturally occurring fires.

These amendments would allow restoration activities (including heavy and mechanized equipment) to occur in site-specific areas, which could result in short-term, adverse impacts to the recreation setting, opportunities/activities, and desired recreation experience as well as to inventoried roadless areas within the project area. The impacts would occur because equipment would be allowed to cross slopes greater than 40 percent and would allow fire to burn through more areas than is currently allowed. Hence the recreation experience would be altered, particularly sights and sounds from surface disturbance, increase in human presence, noise, presence of equipment, smoke, and short-term area closures. The impact would most affect dispersed recreation uses such as hiking, hunting, and seeking solitude since these activities typically avoid the types of activities proposed under the plan amendments (included under the proposed action). The impacts would be short term and localized but would be adverse while the activity is occurring and immediately after the restoration activities are completed. Once the restoration activity is completed, the impacts to dispersed recreation settings, activities/opportunities, and desired recreation experience would cease, and recreation users would be expected to return to these treated areas as time goes by because improving forest health and resiliency also improves the recreation setting and therefore provides various recreation opportunities. These amendments allow treatments to occur that would result in long-term, beneficial impacts to recreation and inventoried roadless areas within the project area because they allow more acres to be treated and treatment conditions to last longer, resulting in:

- Greater ecological diversity, offering an expanded recreation setting;
- Greater resiliency to wildfire, offering decreased risks for public recreation and infrastructure closures due to public safety; and
- Improved forest health in the inventoried roadless areas, reducing the need for future road construction and maintaining the area's roadless values.

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to recreation, infrastructure, and the Jefferies Canyon Inventoried Roadless Area from the no action alternative and proposed action. The proposed action would result in short-term adverse impacts to recreation, infrastructure, and inventoried roadless areas due to closures, reduced access, or disturbance, but would result in long-term beneficial impacts to recreation setting following restoration.

3.10 Range Resources

This section details the affected environment and environmental consequences from the alternatives to rangeland resources. This section also describes the methodology and assumptions used to analyze impacts to range resources from the alternatives.

3.10.1 Affected Environment

The project area contains all or part of 17 grazing allotments: Agua Chiquita–Trail, Alamo Watershed, Bear Creek, Bounds, Carrissa, Cridebring, Davis, Ehart, EK-North Blue Water, Jeffers, North Harbert, Pendleton, Perk, Pinon Draw, Russia Canyon, Sacramento, and Scott Able (Figure 3-42). Within these 17 allotments, there are two closed allotments and 15 active livestock grazing permits, all of which are for cow/calf operations. The 17 allotments total approximately 237,808 acres and approximately 128,186 acres of the allotments occur within the project area (54 percent). Table 3-53 summarizes the size of each allotment and pertinent grazing permit details for each allotment.

In the project area, there are 48 pastures total. Each allotment has permitted conditions and timing requirements. The Annual Operating Instructions that are issued annually by the Sacramento District Ranger specify grazing management objectives and adaptive management strategies, including the stocking schedule per pasture within each allotment during specified times of the year. For example, the Bear Creek allotment has two pastures that can have dispersed grazing, or grazing within any pasture within the respective allotment, as needed between May and November (see Table 3-53). The Annual Operating Instructions also inform the permittees the flexibility on timing requirements, seasonal variances that have the potential to impact the grazing schedule, rangeland and livestock/improvement monitoring, and allotment maintenance and construction requirements. This type of grazing management implemented by the U.S. Forest Service allows plant species to grow, set seed, and complete their yearly life cycle without being grazed during the same time every year. The Annual Operating Instructions also discuss strategies for moving cattle around the pastures during their assigned grazing periods to minimize impacts to heavy use areas.

Range improvements, such as fences, water troughs, earthen stock tanks, pipelines, corrals, freshwater spring developments, wells, and windmills, occur within the allotments and are maintained by the permittees as outlined within the provisions of the Annual Operating Instructions. These range improvements are important for preserving livestock distribution and movement, as well as livestock integrity. The Annual Operating Instructions outline the specifications of range improvement maintenance and the current range improvement status. Figure 3-42 represents the grazing allotments and grazing infrastructure within the project area.

The landscape within the project area has been greatly altered from historic conditions. Insects and disease have contributed to an overall decline in forest health in the area as well as changes in stand density, vegetation communities, and fire regimes and hazards. The ecological response units, or vegetation communities, outlined in the Vegetation Communities and Fire and Fuels Resource Report (U.S. Forest Service 2018a) have altered over time due to landscape-scale environment changes. The change in the forest health has, in turn, influenced rangeland health within the project area. In many locations throughout the South Sacramento Restoration Project area, the forest canopy has become dense thus reducing sunlight from reaching the forest floor. The shading of the forest floor can inhibit the growth of forage, particularly native grasses, forbs, and shrubs grazed by livestock. The closed forest stand structures can also result in a moderate to high wildfire risk, which can translate to a substantial risk to life, property, livestock, and rangeland health. Furthermore, tree encroachment detracts from good range conditions in several parts of the project area (Allen 2018).

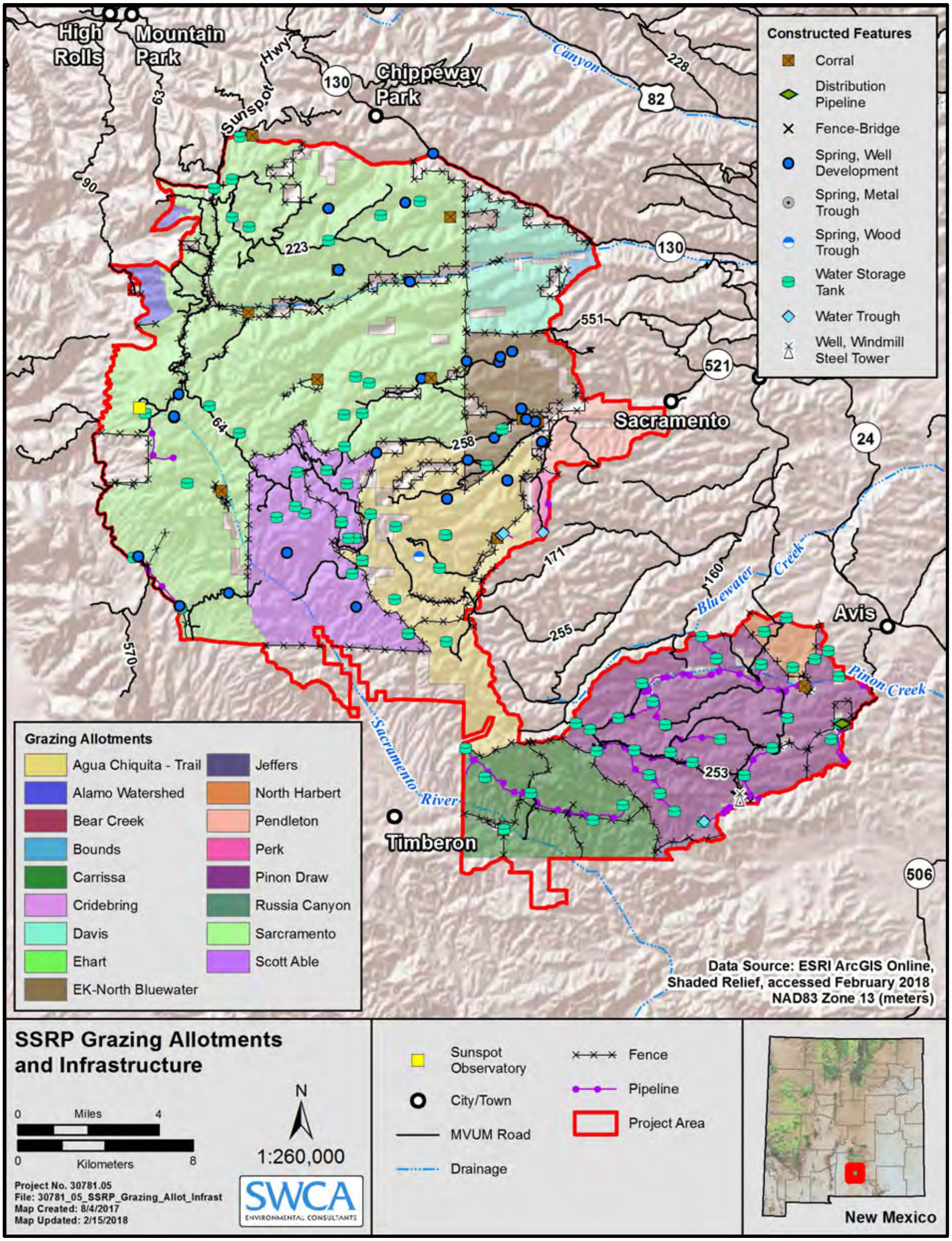

Figure 3-42. Grazing allotments and livestock grazing infrastructure within the South Sacramento Restoration Project Area.

Table 3-53. Grazing Allotment Information within the Proposed Project Area

Allotment Name	Allotment Size (acres)	Acres of Allotment within South Sacramento Restoration Project (percent of total allotment)	Number of Permits	Number of Animal Unit Months	Number of Pastures	Permitted Conditions and Timing Requirements
Agua Chiquita-Trail	28,714	14,863 (52%)	1	275 C/c + 60 C/c *(term permit + private land term permit)*	5	Dispersed grazing from May 1 to October 31
Alamo Watershed	4,385	1,102 (25%)	0	0	–	Allotment closed to grazing
Bear Creek	6,276	13 (<1%)	1	40 C/c	2	Dispersed grazing May 16 to November 15
Bounds	924	333 (36%)	1	2 C/c	2	Dispersed March 1 to February 28
Carrissa	9,604	9,602 (99%)	1	102 C/c	5	Carrissa and Jeffers Allotments operate under one permit and are grazed year-round
Cridebring	1,699	43 (3%)	1	37 C/c	1	Dispersed grazing
Davis	5,354	5,339 (99%)	0	0	–	Allotment closed to grazing
Ehart	4,024	<1 (<1%)	1	40 C/c	2	Two pasture rotations from June 1 to October 31
EK-North Bluewater	5,477	5,472 (99%)	1	208 C/c	6	Dispersed grazing with guidelines to rotate March 1 to February 28
Jeffers	891	211 (24%)	1	20 C/c	1	Carrissa and Jeffers Allotments operate under one permit and are grazed year-round
North Harbert	5,764	1,451 (25%)	1	63 C/c	3	North and Middle pasture from June 1 to September 15 and South pasture from September 16 to October 26
Pendleton	4,203	2,821 (67%)	0	0	–	Allotment closed to grazing
Perk	4,089	592 (14%)	1	55 C/c	1	Dispersed grazing June 1 to October 31
Pinon Draw	28,714	19,215 (67%)	1	150-375 C/c	6	Dispersed grazing March 1 to February 28
Russia Canyon	4,222	27 (<1%)	2	32 C/c + 6 C/c (shared allotment)	3	Dispersed grazing March 16 to October 31
Sacramento	111,168	54,802 (49%)	1	412 C/c (summer) 335 C/c (winter) 5 horses (year-round)	8	Summer pastures dispersed grazing May 15 to October 31 Winter pasture dispersed November 1 to May 14
Scott Able	12,300	12,300 (99%)	1	100 C/c	4	Pasture rotation from May 20 to November 15
	237,808	**128,186 (54%)**	**15**	**Not summed due to seasonal variation**	**49**	

* C/c = Cow/calf operations; the calf is not included as an individual for the number of permitted livestock.

** Per the Allotment Annual Operating Instructions, bulls are included in the number of C/c, but vary in each allotment.

3.10.2 Methodology and Assumptions Used for Analysis

Methodology

Analysis of the existing condition of rangeland resources and the potential effects on these resources from the alternatives was conducted through a review of available U.S. Forest Service data, annual operating instructions for the allotments, information gathered from permittees/allotment participants, and the professional judgement of specialist(s).

The analysis of effects on range resources within the project area is largely based on U.S. Forest Service geographic information system data and discussions with U.S. Forest Service staff with knowledge of the area. The Vegetation Communities and Fire and Fuels Resource Report (U.S. Forest Service 2018a) and the Soils, Hydrology, and Watershed Resource Report (U.S. Forest Service 2018c) were also used for rangeland resource analysis.

Assumptions

Assumptions are based on the resource protection measures, including the standard operating procedures, included in Section 2.2.5.

- Any vegetation available for foraging to livestock that could be removed or burned during implementation of restoration methods is expected to rebound and regrow within two typical growing seasons by following SOP-14.
- All acreage within a given allotment would not be treated at once. On active allotments, the treatment operations and their impacts to grazing operations would be coordinated between district range staff and the permittee. Pasture use would be adjusted, as needed.
- Hazardous material would not harm livestock or the environment the livestock depends on as a result of implementing of spill prevention, control, and containment plan outlined in SOP-10.
- Rutting of access roads and permanent damage to the landscape that could impact the physical health of livestock would be avoided by avoiding treatments to the forest during periods of heavy precipitation.

3.10.3 Environmental Consequences

Alternative 1 – No Action

Under the no action alternative, there would be no vegetation treatments to modify stand structure in order to restore overall forest health for each ecological response unit in the project area. Vegetation thinning using mechanical and manual treatments would not occur and the overgrown conifer forests with unnaturally high densities of small size-class trees would remain (U.S. Forest Service 2018a). The overgrown forests would continue to adversely impact rangeland health by suppressing forage availability, including native grasses, forbs, and shrubs for livestock.

As shade-tolerant species become dominant and alter the species composition of the forest, the grasses, forb, and shrub matrix of the forest would decline. The canopy would continue to grow more dense and the resources needed for the understory, including water and sunlight, could become limiting. In the long-term, the stand structure would become more uniform and would create a less diverse plant species population. These effects resulting in poor forest health would create adverse impacts to rangeland resources, including limiting the growth of livestock food sources, particularly native grasses, forbs and shrubs.

If the overgrown stand density remains in the current conditions, there is potential for an increase in hazardous fuels, thereby increasing the risk for wildfires.

Under the no action alternative, prescribed burning, pile burning, and jackpot burning would not occur. If the historic fire-adapted ecosystems are not maintained and/or restored, the vegetation would decline, including the availability of grasses, forbs, and shrubs for livestock grazing. The overgrown understory would continue to increase, which would elevate the risk of wildfire within grazing allotments over the long term.

Alternative 2 – Proposed Action

The proposed action is designed to implement several forest restoration methods that could be used to achieve desired conditions at the fine, mid, and landscape scales. Chapter 2 describes the restoration methods that would be implemented to restore the forest to a healthy state to benefit rangeland resources.

Direct and Indirect Effects

Implementing the proposed action would have both adverse and beneficial short-term impacts to rangeland resources. Impacts from each restoration method are discussed below. Overall, the Bear Creek, Bounds, Cridebring, Ehart, and Russia Canyon allotments would have minimal impacts from the proposed action as only a small amount of acreage associated with these allotments overlaps the project area (see Table 3-53).

Range infrastructure, including fences and stock tanks, would likely not be affected by the proposed action because the U.S. Forest Service would coordinate proposed treatment activities with permittees prior to implementation. In addition, the forest restoration treatments would reduce the risk of wildfire in some parts of the forest, which would help protect range improvements from wildfire events.

Resource protection measures described in Section 2.2.5, specifically rangeland management, would help minimize, avoid, or mitigate adverse short-term effects on rangeland resources.

Vegetative Thinning

It is expected that up to 35 percent of the project area (approximately 54,000 acres) would be treated using vegetation thinning restoration methods over a 20-year period. Vegetation thinning would result in localized ground disturbance, including disturbance from personnel and heavy equipment used for ground-based timber removal, mastication, machine piling, and skyline yarding. The ground disturbance would create a short-term reduction in the amount of forage available for livestock because grasses and forbs would be trampled, and uprooted in some cases, during vegetation thinning treatments. This adverse impact is expected to last one to two growing seasons after treatment activities conclude in a particular area, depending on precipitation.

To address these short-term adverse effects on rangeland from vegetation thinning treatments, the U.S. Forest Service would coordinate with grazing permittees prior to implementation of forest restoration treatments. These short-term effects on portions of the allotments that experience vegetation thinning treatment could result in a rest period within treated allotments, if determined necessary by the U.S. Forest Service.

Long-term beneficial effects on rangeland resources could result from debris left over from vegetation thinning treatments, which could enhance soil productivity and resilience to invasive nonnative species. The remaining slash debris contains significant amounts of carbon and nitrogen which regenerates the soil fertility leading to more plant processes and ultimately plant diversity. The debris also acts as a natural mulch which increases soil water availability. Both processes coupled together work to suppress the introduction of nonnative species and enhance native vegetation communities (Kirkland 2012). Suppressing nonnative species and increasing soil productivity from debris would create long-term beneficial impacts to rangeland resources, including more forage availability for livestock.

Thinning would also reduce tree density and open the forest canopy in many areas. By opening the canopy, more light would be allowed to reach the forest floor which would reduce competition for sunlight, soil, and water resources among plant species, facilitating increased growth. The increase in understory plant species, including native grasses, forbs, and shrubs, would increase available forage for livestock, resulting in a long-term, beneficial effect to rangeland resources.

Use of Fire

The proposed action includes approximately 108,120 acres of forest restoration using prescribed fire treatments. Prescribed fire would be applied in a manner that consider safety, current and predicted weather, topography, vegetation, and the intensity of fire needed to meet restoration goals. Prescribed fire treatments would be implemented in appropriately-sized burn units throughout the project area, over the 20-year project duration. The short-term impacts to rangeland resources from prescribed fire would include the closure of certain areas during prescribed fire treatments which would limit the amount of available forage to livestock on National Forest System lands and impact allotment management. Permittees would need to find other locations for their livestock to browse during temporary closures of portions of their grazing allotments. Other short-term effects on rangeland resources would include the consumption of vegetation by fire, thereby reducing available forage. Vegetative biomass would be expected to rebound after prescribed fire is applied; therefore, grasses and forbs would regenerate after one or two growing seasons, depending on precipitation.

To address these short-term adverse effects on rangeland from prescribed fire treatments, the U.S. Forest Service would coordinate with grazing permittees prior to implementation of prescribed fire activities. These short-term effects on portions of the allotments that experience prescribed fire treatment could result in a rest period prior to and after implementation within treated allotments, if determined necessary by the U.S. Forest Service.

In some instances, small sections of a prescribed burn or burn piles may burn too hot, thereby scorching the root crown and killing plants entirely. Creating areas of bare ground could lead to an introduction or propagation of nonnative invasive species (Zouhar and others 2008). The spread of nonnative invasive species would be a long-term, adverse effect on rangeland resources. However, resource protection measures would be put in place to avoid and monitor the potential spread of nonnative invasive species, including SOP-14, SOP-17, Veg-15, and Rx-3 (see Section 2.2.5 for addition details regarding these resource protection measures).

Similar to vegetation thinning treatments, beneficial impacts to rangeland resources would result from prescribed fire treatments over the long term. The application of prescribed fire would reduce tree density and open the forest canopy in many areas, encouraging the growth of native grasses and forbs grazed by livestock. In addition, prescribed fire improves soil nutrient cycling and in turn promotes plant productivity (Neary and others 1999). The increase in understory plant species, including native grasses, forbs, and shrubs, would increase available forage for livestock.

Herbicide Applications

Herbicide application methods would be used on a limited basis throughout the project area to control juniper and oak seedlings and the resprouting of these species. Only chemicals that have been registered with the U.S. Environmental Protection Agency and have a completed risk assessment would be used. Because there are several herbicides available for use under the proposed action, managers would be able to use the most selective, most effective herbicide for site-specific conditions. Use of more selective herbicides would result in less collateral damage to native plant species to achieve the same or better level of juniper and oak seedlings and resprout management than would be possible with less selective herbicides. There is potential for short-term adverse impacts to livestock species from the potential ingestion of herbicide during treatment. However, the U.S. Forest Service would coordinate with permittees prior to herbicide treatment application to avoid potential for herbicide ingestion from livestock. In addition, herbicide application would not happen all at once within the entire project area and the livestock pastures would be rotated as necessary.

There is potential for beneficial long-term effects from herbicide application on rangeland health, including a healthier habitat with fewer scrub trees to compete with native grasses and forbs that livestock use for forage. When oak and juniper seedlings are controlled, the grass and forb species would be expected to increase, thus creating more forage for livestock.

Other Restoration Methods

Other restoration methods that would be implemented during forest restoration for the project area include site rehabilitation, watershed improvement and erosion restoration, as well as water development (refer to Section 2.2.2 above for details). The negative short-term effects could include short-term closure of allotment areas to implement restoration methods which would limit the amount of available forage to livestock on National Forest System lands and impact allotment management. Permittees, in coordination with the Forest Service, would need to find other locations for their livestock to graze if temporary deferments of portions of their grazing allotments are necessary to ensure vegetative recovery. Although there is potential for negative short-term effects for rangeland resources, particularly deferment of certain areas to implement other restoration methods, the U.S. Forest Service would coordinate with permittees in advance of implementing restoration treatments to minimize adverse effects on rangeland resources and permittee operations.

The potential for beneficial long-term effects from the implementation of other restoration methods is substantial for rangeland resources. The watershed restoration methods would encourage the growth of more forage for livestock species because active erosion would be stabilized, hydrologic function would improve, and over time, native grass, forb, and shrub species would become reestablished in previously eroded areas. Implementing watershed restoration techniques, including the design and stabilization of headcuts in upland areas and along roadsides, would allow for aeration of meadows for plantings to increase diversity of forb and grass species. The creation of water developments would benefit rangeland health by facilitating livestock distribution which in turn would help limit overgrazing by aiding in the natural movement of livestock around the pastures (U.S. Forest Service 2018c).

Special Use Authorizations

Special use authorizations would be used to support forest industry activities, such as sorting yards, log processing sites, mobile incinerator sites, etc. The goal is to have more forest resource utilization and increase transportation mobilization. The special use areas, as described in Chapter 2, would largely be 10 acres or less and located in disturbed areas, whenever feasible. Special use authorizations would not have a substantial impact to grazing operations. The special use areas would include fencing around the site, if necessary, to exclude livestock.

The spread of nonnative invasive species from special use authorizations, including increased vehicular movement from sorting yards and log processing sites, could potentially occur. The spread of nonnative invasive species would be a long-term, adverse effect to rangeland resources. However, resource protection measures would be put in place to avoid and monitor the potential spread of nonnative invasive species, including SOP-14, SOP-17, Veg-15, and Rock-3 (see Section 2.2.5 for additional details regarding these resource protection measures).

Road Management

Existing roads do not produce forage; however, they do facilitate allotment management and permittees to have easy access to their livestock and associated pastures. There is potential for negative short-term effects on range resources associated with road closures or construction of new roads within allotments. Permittees may have limited access to their allotments which could limit their ability to manage livestock on a short-term basis. The proposed action could result in temporary displacement of fence lines or limited access to water tanks, which could cause the permittees to defer use of pastures during South Sacramento Restoration Project implementation. However, the impacts associated with road management activities would be negligible since the Annual Operating Instructions would ensure permittees have other access routes when road management is being implemented. Annual Operating Instructions would outline the pasture rotational schedule to mitigate impacts to rangeland resources by closing certain pastures while road management is taking place.

There is potential for beneficial long-term effects from road management, including more access routes for permittees to access or retrieve their livestock in the future and the improvement of existing access roads. The improvement of steep roads that do not allow for adequate water flow could also benefit rangeland resources by allowing a healthier ecosystem for livestock species. If ecosystems downslope of road improvement activities have more nutrients, including more water, then grasses and forb species needed by livestock would receive a beneficial impact. Road management objectives are anticipated to improve the watershed regime of the project area. Moving existing roads out of streams and drainages could also have a positive beneficial impact on livestock by improving the quality of their water source.

Cumulative Effects

See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on range resources.

The cumulative effects analysis area for the action alternative is the Lincoln National Forest, Sacramento Ranger District. Most of the rangeland resource impacts, including livestock and rangeland improvement resources, would be expected to occur in this area. The cumulative effects analysis considers past, present, and reasonably foreseeable future development and projects and their effects, in combination with the proposed action.

All restoration treatments occurring within the analysis area (see Table 3-1), including Wildland Fire Management, the Westside Sacramento Mountains Watershed Restoration and Fuels Reduction Project, the Two Goats Forest Restoration Project Decision, etc., would act to cumulatively reduce wildfire hazard on a landscape scale. Cumulative risk reduction of uncharacteristic wildfire would mitigate adverse impacts to native communities, including providing greater protections to native seed sources, reducing nonnative species infestations, providing greater resilience to insect and disease risk and promoting improved watershed function (U.S. Forest Service 2018a). These cumulative effects on the ecosystem health would have a beneficial long-term impact on rangeland resources by promoting restoration and resilience of the herbaceous understory, including native grasses, forbs, and shrubs for livestock forage.

In addition, permanent woody vegetation removal and disturbance resulting from forest restoration treatments within the analysis area have the potential to cumulatively impact rangeland resources, including the potential to adversely impact native vegetation communities and forage for livestock from the spread of nonnative species from restoration activities. The potential to spread nonnative species include increased vehicular movement throughout the analysis area during treatment implementation. Resource protection measures would be implemented as part of the restoration treatments to minimize the spread of invasive nonnative species.

3.10.4 Forest Plan Amendment

The Lincoln National Forest Land and Resource Management Plan amendment would allow mechanized equipment to be used on slopes greater than 40 percent in the project to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives would result in beneficial and adverse impacts to the rangeland resources within the project area. By allowing treatments on steeper slopes, there would be greater access to timber thus creating more timber removal. Within these areas, the forest canopy would be opened, reducing competition for sunlight, soil, and water resources among plant species, facilitating increased growth of grasses and forbs. This would result in long-term beneficial impacts to rangeland resources by allowing more forage opportunities for elk, which could reduce the competition between elk and grazing livestock for forage on flatter slopes.

In addition, treatment areas on slopes greater than 40 percent would reduce fuel continuity and reduce stand densities, thereby mitigating crown fire potential and the risk of high-intensity stand-replacing wildfire (U.S. Forest Service 2018a). Long-term beneficial impacts to rangeland resources would result from a decrease in the potential for severe wildfires (historically uncharacteristic of the forest) throughout the project area by implementing mitigation measures (outlined in the resource protection measures in Section 2.2.5) thus reducing danger to livestock, including the reduction of available forage, and range improvements.

No other elements of the proposed Forest Plan Amendment would impact range resources.

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to range resources from the no action alternative and proposed action. Implementing the proposed action would have both adverse and beneficial short-term impacts to rangeland resources. In the short term, temporary removal of forage resulting from treatments, or restrictions on the use of some allotment areas for the duration of treatments, would create an adverse impact for grazing resources, but long-term improvements to vegetation condition and a more open forest structure would increase forage and also reduce the risk of more damaging long-term effects of catastrophic wildfire on range resources.

3.11 Heritage Resources

The heritage resources specialist report (U.S. Forest Service 2018i) is incorporated by reference. See the report for detailed information about data sources, methodology, assumptions, and limitations.

3.11.1 Affected Environment

Known Archaeological Sites

Known archaeological sites were recorded between 1978 and 2016 and include 293 sites that were assigned Forest Service numbers (U.S. Forest Service 2018i). Subsequent investigations subsumed a handful of these resources into existing nearby sites, bringing the total to 285 managed archaeological sites.

Analysis of the occupation type listed for the 285 previously recorded archaeological sites shows that approximately 64 percent (185 sites) have a pre-Contact occupation, approximately 29 percent (84 sites) have a historic-era occupation, and about 7 percent (16 sites) have evidence of pre-Contact and historic occupations. Eight site numbers were subsumed into nearby archaeological sites following their original recordation and are therefore not included in the results.

Pre-Contact archaeological sites are associated with three cultural affiliations: Archaic, Mogollon, and Unknown Aboriginal. Some pre-Contact sites exhibit more than one prehistoric component. Of the 185 pre-Contact sites, 35 sites are structural, meaning that features are present, and 150 sites are non-structural. The most commonly identified features at pre-Contact sites are fire-cracked rock concentrations, ring middens, and rubble mounds that suggest food processing activities and habitation.

Archaeological sites with historic components are culturally affiliated with Anglo/Euro-American populations and support the known chronology of the area. Some historic sites have more than one component. Of the 84 historic sites, 65 are structural and 19 are non-structural. Of the 16 sites with pre- Contact and historic occupations, five are non-structural and 11 are structural. At 10 of these 11 structural sites, the features are associated with the historic occupation. Features like barns, outbuildings, corrals, and cabins at historic sites are indicative of homesteading, ranching, and agricultural activities. Industrial railroad logging features include trestles, log chutes, railroad grades, timber landings, and switchbacks. Many historic features are flammable because they are crafted from local timber.

Of the 285 known archaeological sites in the proposed project area, 82 currently are determined eligible for the National Register of Historic Places, 34 are determined not eligible for the National Register of Historic Places, and 169 are of undetermined eligibility.

Historic Properties and Resources

The historic properties within the project area include 65 buildings and structures associated with the Sacramento Peak Solar Observatory (U.S. Forest Service 2018i). In 2016, CH2M Hill submitted (on behalf of the National Science Foundation) a report for State Historic Preservation Office review titled *Cultural Resources Evaluation, National Solar Observatory (Sacramento Peak Observatory) Sunspot, New Mexico* under New Mexico Cultural Resource Information System number 137093. In this report, historic-era built environment resources at Sacramento Peak Observatory were evaluated for their potential eligibility for listing in the National Register of Historic Places to determine if the Observatory contained historic properties or constituted a potential historic district. Expanding the search area to within 1 mile of the project area adds one additional property—a building at the South Rockies 4H Camp located southeast of Sunspot. This building (Historic Cultural Properties Inventory number 31819) was recorded by the Forest Service under report number 2013-08-064 and New Mexico Cultural Resource Information System number 127441.

Traditional Uses

Within Apache memory, the Sacramento Mountains have been the homeland of the Mescalero for as long as oral history has been handed down from their ancestors. When the Spanish moved through the area in 1534, the Mescalero Apaches seasonally roamed a vast range of present New Mexico from the headwaters of the Rio Grande east to the Pecos River and south into Chihuahua, Mexico. The Spanish bestowed many of the geographic names familiar today, including Sierra Blanca (White Mountain), the snow-covered peak marking the center of creation, according to the Mescalero tradition (Opler 1983, pages 432 and 433). Early ethnographic research (Basehart 1967, 1974; Opler 1983; Sonnichsen 1973), as summarized by Sebastian and Larralde (1989, pages 114 through 117), provides information on Mescalero culture from the mid-1800s. More recent ethnographic research is provided by Ball (2009) and Goss (2004) and is summarized by Brown and others (2010). These texts provide cultural ecological models of land use, descriptions of origin stories, and oral traditions related to traditional cultural properties. By the mid-1800s, the Mescalero were experiencing external pressures on multiple fronts: from the Comanche who pushed them off their traditional bison hunting grounds, to the Hispanic and Anglo settlers encroaching on the frontier, to the U.S. Army, who established military forts in New Mexico in 1855. A detailed account of Mescalero land use patterns within the Sacramento Mountains is included in the heritage resource report (U.S. Forest Service 2018i).

State Registered Properties

The state registered (SR) properties within the project area are SR 775, SR 1752, SR 1753, and SR 1754. SR 775 is the Main House of Circle Cross Ranch which was built between 1906 and 1908 by Oliver M. Lee, one of the most prominent ranchers in southeastern New Mexico. SR 1752 is the Hay Canyon Logging Camp, SR 1753 is the Wills Canyon Spur Trestle, and SR 1754 is the Hubbell Canyon Log Chute; these three registered properties are associated with the railroad logging industry in the Sacramento Mountains.

Previous Investigations

The Archaeological Records Management Section database shows that 392 previous investigations occurred between 1976 and 2017 within 1 mile of the proposed project area. Information from the Forest Service database indicates 281 previous investigations within the project area (U.S. Forest Service 2018i). In total, 83,191 acres have never been surveyed and 48,254 acres were surveyed prior to 2003. Only 56 surveys covering 11,454 acres have occurred within the past 15 years; these surveyed areas are illustrated in Figure 3-43.

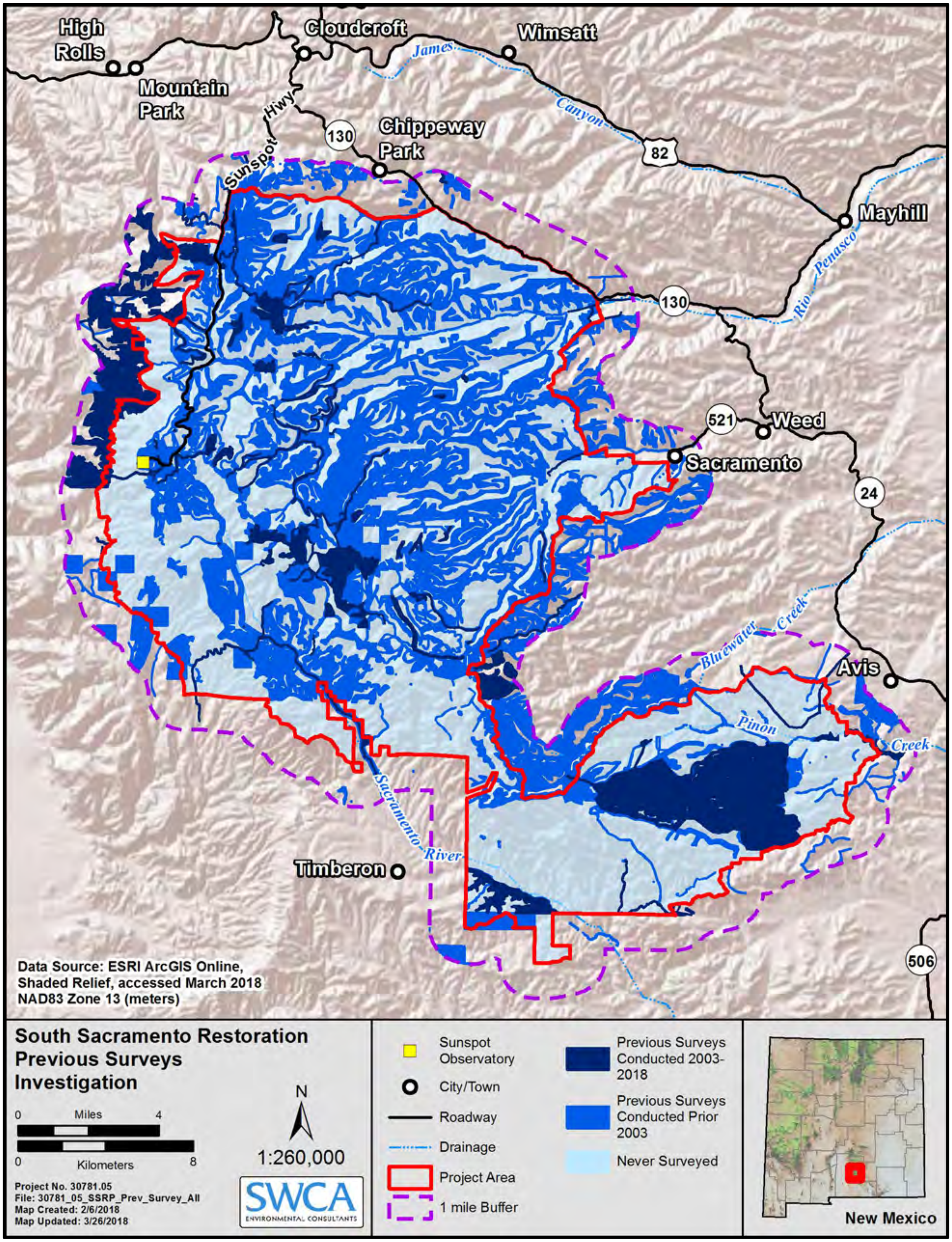

Figure 3-43. Previous surveys meeting current archaeological standards.

3.11.2 Methodology and Assumptions Used for Analysis

U.S. Forest Service records were reviewed at the Forest Service Supervisor's Office on July 27 and 28, 2017. Using the New Mexico Cultural Resource Automated Information System database and a shapefile of the proposed project area, Forest Service archaeologists Hila Nelson and Bill Sapp produced a list of previously recorded archaeological sites and previously conducted archaeological surveys in the project area and within 1 mile (1.6 kilometers) of the project area. Field records were reviewed for each previously recorded site to verify the presence or absence of features, eligibility determinations, date of the site's last recording, and component types.

Custom record searches through the online Archaeological Records Management Section database and the online Historic Preservation Division database were conducted in September 2017 for previously recorded archaeological sites and previously conducted archaeological surveys in the project area and within 1 mile of the project area. The Historic Preservation Division and National Register of Historic Places database records search was also conducted in September 2017 for properties listed in the National Register of Historic Places and State Register of Cultural Properties within 1 mile of the project area.

Data from the Forest Service indicate 293 previously recorded sites, as well as four state registered properties and 66 historic buildings, are within the project area and 1-mile buffer; and 281 surveys were previously conducted in the project area and 1-mile buffer.

3.11.3 Environmental Consequences

Alternative 1 – No Action

Under the no action alternative, no new vegetation thinning, prescribed fire, herbicide, or watershed improvement treatments would be implemented in the project area. Implementation of any previously approved projects and planning of future projects that may affect the area would continue (e.g., fire suppression, treatment of nonnative invasive plants, rangeland management, road maintenance, and others). The no action alternative for this project includes consideration of long-term projections of forest conditions and trends and wildland fire risk. The no action alternative does not address the purpose and need for the project; however, it serves as a baseline against which the effects of the action alternative can be compared.

In the absence of vegetation thinning treatments and fire management strategies under the no action alternative, existing fuel loads would continue to accumulate, increasing the risk for more intense fire behavior in the event of an unplanned ignition. The lack of forest restoration treatments under the no action alternative would not directly impact heritage resources. However, the trend toward increased fuel loading and tree mortality from insects and disease would continue; thereby increasing the risk of wildfire events, which can be detrimental for heritage resources with structural features, particularly those resources with flammable features.

Alternative 2 – Proposed Action

Direct and Indirect Effects

The proposed action would result in both adverse and beneficial impacts to heritage resources. Known cultural resources would be identified and located as part of the vegetation thinning and prescribed burn plan processes. Heritage resources would either be avoided during treatments or prepped prior to treatments in order to mitigate impacts. Chapter 2 provides a list of resource protection measures for heritage resources. Through adherence to resource protection measures, impacts to heritage resources would be negligible to minor. Potential impacts to heritage resources are discussed below, by restoration method.

The scenery report (U.S. Forest Service 2018g) provides detailed analysis for how the proposed action could impact the characteristic landscape in the area, which may be a contributing element to some heritage resources in the area.

Vegetation Thinning

Vegetation thinning treatments could result in minor impacts to undiscovered heritage resources as a result of disturbance of surface vegetation and soils, potential exposure of buried artifacts and features, or impacts of compaction due to tracks from heavy machinery. Appropriate thinning methods would be carefully selected in order to avoid adverse effects within the boundaries of historic properties. Vegetation thinning would be beneficial in some areas where overstocked woodland and forest vegetation threatens the long-term persistence of heritage resources due to the potential for extreme wildfire or the degrading nature of vegetation on the integrity of the artifact as a result of root growth and surface vegetation growth and decay.

The landscape character would temporarily change to a more industrialized setting due to the equipment used for thinning and the sights of slash, tree stumps, and woody debris. However, the characteristic landscape would be improved in the long term by the creation of more open spaces and views, increases in mature trees and diverse vegetation, and overall improved forest health (U.S. Forest Service 2018g).

Use of Fire

Through the avoidance of fire sensitive sites (as defined in the Region 3 Programmatic Agreement, Appendix D, Attachment 2), and mechanical pre-treatment of heavy fuel loads, prescribed fire could beneficially impact cultural resources through reducing the hazardous fuel loading and potential for future, more damaging wildfire. Use of prescribed fire would increase the potential for lower-intensity ground fires, which make them easier to manage with shorter burn times, thus reducing the potential risk of damage to cultural resources. Fast-burning prescribed grass fires would have negligible impacts on cultural resources, but they can be used to reduce the fine fuel component that could spread fire to forested and woodland fuels in the event of an unplanned ignition.

The landscape character would be adversely altered because prescribed fire temporarily introduces areas of dark color into the landscape via tree scorch, burnt soil, and blackened understory. The loss of vegetation would also adversely impact the landscape character. This typically lasts 2 to 5 years, resulting in short- and long-term impacts. In the long term, broadcast burning treatments have the potential to have beneficial impacts and improve scenery resources and therefore the characteristic landscape (U.S. Forest Service 2018g).

Because of the forest restoration treatments under the proposed action, fuel loads would be removed from many locations within the project area, thereby reducing the risk for higher-intensity wildfire behavior in the event of an unplanned ignition. The proposed action would work to reverse the existing trend toward increased fuel loading and tree mortality from insects and disease; thereby reducing the risk of wildfire events.

Herbicide Applications

The targeted use of herbicides to control oak and juniper resprouts is not anticipated to affect cultural resources with resource protection measures in place.

Other Restoration Methods

Most of the other restoration treatments would disturb the ground and so might affect cultural resources: site rehabilitation and planting, watershed improvements and erosion control, water developments. Ground-disturbing activities can crush, compact, move, break, or destroy artifacts and features above and below the ground, or even an entire site. These effects can range in intensity. Information about a cultural site may be lost as well as the characteristics that make historic properties eligible for the National Register of Historic Places. Resource protection measures have been identified to mitigate the effects on cultural resources from implementation of other restoration methods.

Road Construction and Maintenance

Ground-disturbing activities, such as road construction and maintenance, can crush, compact, move, break, or destroy artifacts and features above and below the ground, or even an entire site. These effects can range in intensity. Information about a cultural site may be lost as well as the characteristics that make historic properties eligible for the National Register of Historic Places. Resource protection measures have been identified to mitigate the effects on cultural resources from road construction and maintenance activities.

Cumulative Effects

Past, present, or reasonably foreseeable future projects on public lands near the project area would undergo evaluation under Section 106 of the National Historic Preservation Act. By following resource protection measures and complying with applicable laws, impacts to cultural resources would either be avoided or mitigated. Unanticipated discoveries during proposed activities typically result in work ceasing in the area and a qualified Forest Service staff member visiting the site to assess conditions and develop a course of action associated with the unanticipated discovery. Therefore, there would be no cumulative adverse impacts to heritage resources under the proposed action from planned actions by the Forest Service and other public entities.

3.11.4 Forest Plan Amendments

The Forest Plan amendment that would allow mechanized equipment to be used on slopes greater than 40 percent in the project to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives would have both adverse and beneficial impacts to cultural resources in the project area. Adverse impacts to cultural resources could occur if undiscovered resources are crushed, moved, or destroyed from mechanized treatments. These adverse effects would be negligible due to the resource protection measures identified for the proposed action as well as the lower likelihood of heritage resources being located on slopes greater than 40 percent. By expanding the areas in which forest restoration would occur in the project area, wildfire risk would be reduced, and long-term beneficial impacts to heritage resources would result because high-intensity wildfires could consume or degrade heritage resources. In addition, wildfires that produce large amounts of post-fire soil erosion and subsequent sedimentation would be less likely to occur.

Similarly, the proposed amendments allowing forest restoration treatments to occur in Mexican spotted owl protected activity centers would have both adverse and beneficial impacts to cultural resources because fuels in these areas would not be removed without the amendment. Adverse impacts to heritage resources could occur if undiscovered resources are crushed, moved, or destroyed from treatment activities within the protected activity centers. However, these adverse effects would be negligible due to the resource protection measures identified for the proposed action. A long-term reduction in wildfire risk and beneficial impacts to cultural resources would result from the proposed amendment. Forest restoration activities within protected activity centers would improve forest health and resilience in a larger portion of the project area, thereby resulting in decrease in wildfire potential.

The Forest Plan amendment to authorize the management of unplanned wildfires for multiple resource objectives across portions of the project area where this management is not currently authorized would also result in long-term reduction in wildfire risk and subsequent long-term beneficial impacts to heritage resources. Adverse impacts to heritage resources could occur if wildfires that are allowed to burn result in loss of heritage resources through consumption by fire and loss of context surrounding the heritage resource.

Conclusion

Table 2-14 in Chapter 2 summarizes the impacts to heritage resources from the no action alternative and proposed action. Under the proposed action, the risk of high-intensity wildfire behavior would be reduced through the proactive measures of prescribed fire and mechanical and herbicide treatments. The proposed action would work to reverse the existing trend toward increased fuel loading and tree mortality from insects and disease; thereby reducing the risk of wildfire events, which could adversely affect heritage resources. Resource protection measures identified as part of the proposed action would avoid adverse effects on known heritage resources.

3.12 Social and Economic Conditions

The social and economic conditions specialist report (U.S. Forest Service 2018j) is incorporated by reference. See the report for detailed information about data sources, methodology, assumptions, and limitations.

3.12.1 Affected Environment

The project area is located completely within Otero County. The project area is rural with a few communities located near the project area, including Timberon, Weed, Cloudcroft, and Mescalero. In addition to people residing within these communities, the area is home to many residents outside of the community boundaries. The Mescalero Apache Tribe is a federally recognized tribe and sovereign nation. Nearby towns and cities are Alamogordo, Tularosa, and Las Cruces, New Mexico, and El Paso, Texas. Table 3-54 and Table 3-55 summarize the pertinent demographic information for the analysis area.

Table 3-54. Demographic Profile of Local Communities

	New Mexico	Otero County	Timberon	Weed	Cloudcroft	Mescalero
Population	2,059,179	63,797	348	63	674	1,338
Median Age	36.7	36.5	60.6	60.5	48.9	28.1
Median Household Income	$44,963	$39,775	N/A	N/A	$40,417	$31,393
Percent Below Poverty Level	21.0	23.1	51.8	0	19.4	43.7
Unemployment Rate (percent)	9.2	12.7	0	0	10.5	28.9

Source: Community profiles as reported in U.S. Census Bureau (2010, 2015).

Table 3-55. Race and Ethnicity Profile of Local Communities

	New Mexico	Otero County	Timberon	Weed	Cloudcroft	Mescalero
White	68.4	72.7	91.7	95.2	93.0	3.3
African American	2.1	3.5	0	1.6	0.1	0

	New Mexico	Otero County	Timberon	Weed	Cloudcroft	Mescalero
American Indian	9.4	6.7	0.6	0	1.5	95.1
Asian	1.4	1.2	0.9	1.6	0.3	0.1
Native Hawaiian/Other Pacific Islander	0.1	0.2	0	0	0	0
Two or more races	3.7	4.2	3.4	1.6	3.4	1.0
Other race	15.0	11.5	3.4	0	1.6	0.4
Hispanic or Latino[2]	46.3	34.5	15.2	0	8.9	10.7
Not Hispanic or Latino	53.7	65.5	84.8	100	91.1	89.3

Source: Community profiles as reported in U.S. Census Bureau (2010, 2015).

In all local communities, except for Mescalero, the majority of the population is white and not Hispanic or Latino. The proportion of white and not Hispanic or Latino populations are greater than in Otero County and New Mexico. In Mescalero, the majority of the population is American Indian, at 95.1 percent, and not Hispanic or Latino, at 89.3 percent.

Poverty levels in the analysis area vary. Timberon and Mescalero have higher percentages of people living below the poverty level, compared with Otero County and New Mexico. Poverty levels in Weed and Cloudcroft are lower than Otero County and New Mexico.

Based on the minority status and poverty level figures presented in Table 3-54 and Table 3-55, the communities of Mescalero and Timberon can be considered environmental justice communities near the project area.

Employment Profile

The Lincoln National Forest contributes to economic activity in Otero County and the surrounding region by providing recreational opportunities as well as timber, energy and minerals, and livestock grazing. Payments to states and counties from the Forest Service program revenues and royalties support schools, road maintenance, stewardship projects, and county government operations. Additionally, Forest Service investments in infrastructure, ecosystem restoration, forest health, and salaries further support jobs and income in the local economy. In 2014, the Lincoln National Forest supported an estimated 1,110 jobs in local communities and an estimated $48,400,000 of annual labor income for wage earners and business sole proprietors (U.S. Forest Service 2017j). Approximately 60 jobs annually and $15,300,000 in direct and secondary labor income are attributed to the forest products sector (for more detail see Table 5 in U.S. Forest Service 2018j).

Forest Products Industry

The Lincoln National Forest encompasses approximately 1.1 million acres, 957,000 acres of which is considered forest land and 143,000 acres non-forest. Forest land can generally be subdivided into two land categories: timberland and woodland. Timberland is composed mostly of industrial wood species such as ponderosa pine and Douglas-fir, whereas woodland forests are composed of pinyon pine, juniper, and oak species. The forested portion of Lincoln National Forest is 24 percent timberland and 76 percent woodland (U.S. Forest Service 2017k). Since 1990, approximately 77,000 acres, or 34 percent

[2] Hispanic or Latino refers to a cultural identification, such as Mexican, Puerto Rican, or Spanish; it is not a race. Hispanics or Latinos can be of any race and are not included as a separate category in the race distribution.

of timberland on the Lincoln National Forest, has been treated through commercial timber sales (U.S. Forest Service 2017k).

The volume of timber cut and sold on the Lincoln National Forest is described in the social and economic conditions report (U.S. Forest Service 2018j).

New Mexico’s primary forest products industry in 2012 consisted of 28 active manufacturers in 13 counties. Facilities were located near the forest resource in north-central New Mexico and Otero County. Currently, there are five active small production sawmills in Otero County, one full production pallet mill in Canutillo, Texas, and multiple firewood processors throughout Otero, Lincoln, Chaves, and Eddy Counties. Local sawmills and processors produce products such as

- Architectural beams
- Framing lumber
- Pallet stock and cants
- Railroad cross-ties
- Oil well and equipment mats and oil well cribbing
- Utility poles
- House logs
- Bagged dried shavings
- Firewood

Forest products enterprises support the economic well-being of many local forest-dependent communities and enable forest restoration efforts that are aimed at reducing the risk of severe wildfire while improving the health of the state’s forest resources (Egan 2011).

Wildfire Exposure Costs

Wildfire federal firefighting costs for suppression efforts have increased from $239 million in 1985 to $2.1 billion in 2015, whereas the size of area burned has more than tripled (from 2.8 to 10.1 million acres) during the same time period (National Interagency Fire Center 2015). Per-acre firefighting costs for suppression efforts range from the lowest value in 2009 of $155.45 to the highest value of $423.34 in 2014 (for full data, the social and economic conditions report [U.S. Forest Service 2018j]). Huang and others (2013) estimate fires suppression costs can reach $625 per acre to $1,909 per acre for federally managed large wildfires that are over 300 acres.

The suppression costs described above do not include other costs associated with wildfires, such as loss of life and property; infrastructure replacement for transmission lines, roads, water supply infrastructure, etc.; post-fire rehabilitation; loss of timber volume and woody biomass; changes in recreation visitation; or loss of ecosystem services, such as water supply, forage, and carbon sequestration. A review of a sample of very large (greater than 40,000 acres) New Mexico wildfires between 2009 and 2012 indicates that total costs of wildfires can range from 2 to 29 times greater than the suppression costs (Impact DataSource 2013). Total costs of wildfires are influenced by the density of residences and structures damaged by a wildfire, population density of the burned area, and costs incurred by individuals and businesses (Impact DataSource 2013). For example, a wildfire near a heavily populated area may result in higher evacuation costs and smoke-related illnesses compared to a less densely populated area. Taking the midpoint of the range, a total cost factor of 12.7 times the suppression costs of New Mexico wildfires, it is estimated that wildfires in New Mexico have a total cost of approximately $1,600 per acre (Table 3-56).

Table 3-56. New Mexico Wildfire Full Cost Estimates for a Sample of Large Wildfires (2009 to 2012)

Fire Event	Year	Acreage	County Population Density	Wildfire Suppression Costs ($)	Low Total Cost Factor (1.9 times)	Mid Total Cost Factor (12.7 times)	High Total Cost Factor (29.0 times)
Whitewater-Baldy	2012	297,845	0.5	$23,000,000	$43,700,000	$292,100,000	$667,000,000
Little Bear	2012	44,330	4.2	$19,400,000	$36,860,000	$246,380,000	$562,600,000
Las Conchas	2011	156,593	35.5	$48,385,000	$91,931,500	$614,489,500	$1,403,165,000
Miller	2011	88,835	7.5	$18,100,000	$34,390,000	$229,870,000	$524,900,000
Donaldson	2011	101,563	4.2	$5,700,000	$10,830,000	$72,390,000	$165,300,000
Last Chance	2011	53,342	12.9	$2,062,400	$3,918,560	$26,192,480	$59,809,600
Enterprise	2011	64,936	14.7	$37,000	$70,300	$469,900	$1,073,000
Cato	2009	55,080	10.8	$460,000	$874,000	$5,842,000	$13,340,000
Pasco	2009	93,029	1.4	$450,000	$855,000	$5,715,000	$13,050,000
Average	**–**	**106,173**	**10.2**	**$13,066,044**	**$24,825,484**	**$165,938,764**	**$378,915,289**

Source: Community profiles as reported in U.S. Census Bureau (2010, 2015).

Social and Non-market Values

The economic values of Forest Service management are not entirely captured in market transactions. Much of the value of the national forests is non-market in nature. The term *non-market values* refers to the benefits individuals attribute to experiences of the environment or uses of natural and cultural resources that do not involve market transactions and therefore lack prices. This includes direct and indirect use values and also non-use values (sometimes referred to as passive use values). Use values include the benefits an individual directly derives from some experience or activity, such as climbing a spectacular peak, hunting, or wildlife viewing. Use value also includes indirectly received benefits, such as from ecosystem services, which are environmental functions, processes, and characteristics that are valuable to people because they support, enable, or protect human activity. Healthy forests provide numerous ecosystem services, including clean water and air, biodiversity, reduction in wildfire risks within wildland-urban interfaces, forest products, and other goods and services. The analysis of environmental consequences from the proposed action considers non-market goods and services primarily in qualitative terms. When appropriate, discussion of how the alternatives may affect other, non-market, ecosystem services are presented. However, due to the qualitative nature of these discussions, direct comparisons between changes in market and non-market values are generally not possible.

Incomplete or Unavailable Information

Information was not available with regard to the costs of all vegetation thinning tools identified under the proposed action. This analysis assumes that these forest product values reflect the current market value for timber cut in the project area for ground-based harvesting. Due to the steep terrain within much of the proposed project area, more expensive logging systems capable of working on these steep slopes, such as skyline and steep slope cut-to-length, are under consideration. These systems would have a higher logging cost than conventional ground-based logging. Because the use of these systems is currently uncommon on the Lincoln National Forest, costs associated with skyline yarding are not incorporated into this analysis.

3.12.2 Methodology and Assumptions Used for Analysis

Table 3-57 identifies the resource indicators and measures that are used to conduct impacts analysis for socioeconomic conditions.

Table 3-57. Resource Indicators and Measures for Assessing Effects

Resource Element	Resource Indicator	Measure (Quantify if possible)	Used to Address: Purpose and Need, or Key Issue?	Source
Economics	Treatment costs	Sum of survey cost, sale preparation costs, sale administrative costs, road costs, prescribed burning costs	No	Not applicable
Economics	Timber value	Dollars per CCF	Yes	Not applicable
Economics	Potential jobs created	Number of jobs	Yes	Not applicable
Economics	Total production of forest products	CCF and dollars	Yes	Not applicable
Economics	Wildfire exposure costs	Dollars	No	Not applicable
Social and Economic	Access	Potential closures	Yes	Not applicable
Environmental Justice	Impacts to minority and low-income communities	Disproportionate adverse impacts	No	Executive Order 12898

In addition to the quantified impact indicators discussed above, the analysis includes a qualitative discussion of social and non-market values such as community resiliency, forest resiliency/ecosystem services, and benefits of collaboration. Temporary loss of visitation revenue is also discussed qualitatively.

Implementation of the project would require several types of fuel reduction methods and other actions that are related to their implementation. Costs to undertake these activities have been estimated using a variety of methods. These costs are only estimates. Actual implementation cost, especially for logging systems not commonly used in New Mexico, may vary substantially. The following discussion identifies the methods for calculating each impact indicator listed in Table 3-57.

Treatment Costs used in the analysis are defined in the social and economic conditions report (U.S. Forest Service 2018j). Table 3-58 provides costs estimates for treatments in the project area.

Table 3-58. Estimated Treatment Costs for the Project Area

Description	Estimated Cost	Comments
Resource Survey Costs	$45 to $60 per acre	Estimated costs for contracted archaeological and botany resource surveys.
Timber Sale Preparation Costs	$70 per acre	Includes staff time for layout, painting and cruising, and the current cost of timber marking paint.
Timber Sale Administrative Costs	$22 per acre	Based on hours spent per year for Forest Service staff to administer active timber sales.
Road Costs	$8,800 to $30,000 per mile	Range is dependent on temporary versus system road specifications. The greater the slope of the road location and drainage culverts can increase construction costs.
Prescribed Burning Costs	$80 to $600 per acre	Broadcast burning is typically less costly than pile burning. This cost is also dependent on the size of the project.

Timber value is the value of the timber to be harvested as it stands on the stump; it is also referred to as stumpage value. This is the monetary amount that a contractor would be willing to pay the government for the timber or the amount that the contractor would need to be paid to harvest and haul the timber from the site; the latter is usually referred to as Below Cost Timber Sale. The timber value is determined by completing a detailed timber sale appraisal described in the social and economic conditions report (U.S. Forest Service 2018j).

It is estimated that of the standing-stem volume in the project area, the sawtimber greater than 9 inches DBH within mixed-conifer ecological response units would have a value to the government of $3.00 per 100 cubic feet and sawtimber within the ponderosa pine ecological response unit (greater than 9 inches DBH) would have a value to the government of $5.00 per 100 cubic feet.

Costs paid to operators for small-diameter treatments through removal, chipping, or masticating would vary greatly, depending on objective and complexity. There is currently only a limited market for small-diameter wood or biomass and most is treated on-site. Recently awarded contracts have been bid out at anywhere from $400.00 to $900.00 per acre (amount paid by the Forest Service to the contractor for product removal). Treatments on steep slopes would require different equipment, and cost about $1,000.00 to $2,000.00 per acre (amount paid by the Forest Service).

Potential Jobs Created – This is an estimate of jobs created through the implementation of forest restoration activities based on historic projects completed in the Lincoln National Forest. These job estimates were provided by the Sacramento District Timber Sale Administrator based previous contracts awarded for similar work. Approximately 75 people are employed at local lumber mills. Additional employment would be expected for stewardship projects and commercial fuelwood businesses.

Forest Products – This is an estimated volume of forest products to be removed from the forest over the life of the project. Potential forest products include sawtimber, poles, posts, firewood, and other products. These volume estimates were provided by the Sacramento District Timber Sale Administrator based on past projects. Refer to the Environmental Consequences section for more information about the potential forest products generated as a result of the project.

Wildfire Exposure Costs – This estimate of exposure to wildfire is based on the number of acres identified as high- and moderate-risk for wildfire. Wildfire suppression costs and other costs associated with wildfire events are calculated using estimates from peer-reviewed papers and costs provided by the Forest Service.

Environmental Justice – This is a qualitative discussion of any disproportionate impacts that could occur to environmental justice communities as a result of the proposed project.

Social and Non-market Values – This is a qualitative discussion of potential changes in community resiliency, forest resiliency/ecosystem services, and benefits of collaboration as a result of the proposed project.

3.12.3 Environmental Consequences

Alternative 1 – No Action

Under the no action alternative, the proposed forest restoration activities would not occur within the project area. Therefore, no beneficial impacts to social or economic conditions would occur. Social conditions could possibly continue to decline as a result of there being no improvement in forest resiliency, ecosystem health, and local employment opportunities from the 140,000-acre project area.

Wildfire risk would continue to increase in the project area; therefore, potential wildfire suppression costs would be incurred by the Forest Service and damage costs to surrounding landowners, if a wildfire were to occur in the project area over the next 20 years. Approximately 46,542 acres within the project area have been identified as at risk of stand-replacing, uncharacteristic wildfire based on current conditions. If we apply the estimated midpoint total cost of wildfire ($1,600 per acre; see Table 3-56) to the acreage identified as at risk to stand replacement, uncharacteristic wildfire, the potential costs of wildfire under the no action alternative would be $74,467,200 (Table 3-59).

Table 3-59. Resource Indicators and Measures for Alternative 1 (No Action Alternative)

Resource Element	Resource Indicator (Quantify if possible)	Measure (Quantify if possible)	(Alternative 1)
Economics	Treatment costs	Sum of survey cost, sale preparation costs, sale administrative costs, road costs, prescribed burning costs	None
Economics	Timber value	Dollars per acre	None
Economics	Total production of forest products	100 cubic feet	None
Economics	Potential jobs created	Number of jobs	None
Economics	Wildfire Exposure Costs	Dollars	$74,467,200
Environmental Justice	Impacts to minority and low-income communities	Disproportionate adverse impacts	None

Alternative 2 – Proposed Action

Direct and Indirect Effects

Under the proposed action, direct and indirect effects on social and economic resources would occur as a result of treatment costs, timber sale revenue, job creation, and wildfire exposure costs. Environmental justice and social values are discussed below.

Treatment Costs

Table 3-60 summaries the itemized treatment costs for the project area. Treatment activities include surveys for resources such as archaeology and botany resources, sale preparation such as timber cruises and tree marking, sale administration, road construction or improvement activities, and costs for prescribed fire. It is important to note that not all of 140,000 acres within the project area would be subject to the same treatments. The areas subject to vegetation thinning and prescribed burning overlap; therefore, the larger prescribed fire acres were used for many of the estimates provided in the table below. In order to implement the proposed action, it is estimated that the Forest Service would need to expend approximately $19 million to $76 million over the 20-year project duration to accomplish the forest restoration activities. Broken down by acre, the project would cost the federal government approximately $133 to $544 per acre to implement.

Table 3-60. Estimated Treatment Costs for the Project

Description	Estimated Cost per Unit	Applicable Units	Estimated Cost for Project
Resource Survey Costs	$45 to $60 per acre	102,600 acres	$4,617,000 to $6,156,000
Timber Sale Preparation Costs	$70 per acre	50,950 acres	$3,566,500
Timber Sale Administrative Costs	$22 per acre	50,950 acres	$1,120,900
Road Costs	$8,800 to $30,000 per mile	125 miles	$1,100,000 to $3,750,000
Prescribed Burning Costs	$80 to $600 per acre	102,600 acres	$8,208,000 to $61,560,000
Total			**$18,612,400 to $76,153,400**

Timber Value and Forest Products

The timber value analysis focuses on forested areas of the project, also described as timberland. Timberland is composed mostly of industrial wood species such as ponderosa pine and mixed conifer. This analysis does not include timber value estimates for woodland forests composed of pinyon pine, juniper, and oak species. As shown in Table 3-61, approximately 42,000 acres of timberland would be treated under the proposed action. From these acres, an estimated 230,000 CCF of timber would be removed from the project treatment areas, yielding approximately $875,000 in total revenue to the federal government.

Table 3-61. Estimated Project Timber Value over the 20-Year Project Duration

Ecological Response Unit	Treatment Acres	9-inch and above Volume (100 cubic feet)	Base Rate	Annual Revenue	Total Revenue (over 20-year period)
Mixed Conifer with Aspen Forests	12,927	76,250	$3.00	$11,437.50	$228,750
Mixed Conifer- Frequent Fire Forests	21,228	123,373	$4.00	$24,675.60	$493,492
Ponderosa Pine	8,093	30,574	$5.00	$7,643.50	$152,870
Total	**42,248**	**230,197**	**–**	**$43,756.60**	**$875,112**

* Note: Table 10 shows 50,950 acres to be treated under the Proposed Action. The difference between 50,950 total acres of treatment and 42,248 acres of timber acres represents 8,702 acres of pinyon-juniper woodland and grass ecological response units, which is not considered timberland.

The annual revenue and total revenue were estimated using the estimated treatment acres of trees with 9 inches or greater DBH multiplied by the base rate for each timber species (conifer or ponderosa pine). It is important to note that the base rate represents the lowest possible price an operator could offer for timber. The base rate is regularly bid up anywhere from a couple cents to a couple dollars at the time of bid, so total revenues are subject to fluctuations in the market. Also, the estimated base rates are set by quarterly regional appraisal bulletins. The base rate represents not only timber value but also provides a baseline for haul costs, road maintenance, slash, skid yard costs, and temporary roads. The baseline of these costs can be adjusted according to haul miles to the nearest finishing mill, current fuel costs, distances from stump to landing, etc., which would offset current base rates either up or down. The final rate is determined by doing a detailed timber sale appraisal.

Based on current market conditions, there is not a strong market for small-diameter timber forest products; therefore, the Forest Service would use a stewardship contract to facilitate the removal of small-diameter timber (Table 3-62). Based on the current median cost for small-diameter timber removal on the Lincoln National Forest, at $750 per acre, it would cost the Forest Service approximately $25 million over the 20-year project duration to have a contractor remove approximately 36,800 CCF of small-diameter timber from the project area (U.S. Forest Service 2017k).

Table 3-62. Estimated Small-Diameter Timber Acres, Volumes, and Removal Costs for the 20-Year Project Duration

Ecological Response Unit	Treatment Acres	Up to 9-inch volume (CCF)	Average Cost for Removal of Small-Diameter Timber
Mixed Conifer with Aspen Forests	12,927	11,566	$7,756,500
Mixed Conifer-Frequent Fire Forests	21,228	17,920	$12,737,250
Ponderosa Pine	8,093	7,314	$4,857,000
Total	**42,248**	**36,800**	**$25,350,750**

The proposed action is designed to support the removal of forest products from the project area. The proposed action outlines criteria for siting special use authorization sites for the forest industry. If a viable economic opportunity arises, such as the use of biochar or pellets, it is possible that small-diameter timber may become a desired commodity over the life of the project. In that case, the cost of small-diameter removal may decrease over time.

Potential Jobs Created

Historically, the Forest Service has observed that 100 percent of the crews hired to complete timber contracts on the Sacramento Ranger District are local residents. Currently, the number of jobs created as a result of Lincoln National Forest timber is about 75 people at local mills. This number does not include incidental employment or commercial fuelwood. Other employment opportunities would result from stewardship projects. The Sacramento Ranger District estimates the project would result in approximately 200 or more jobs at any given time over the life of the project (U.S. Forest Service 2017j). These jobs may be filled by out-of-state crews if operators with equipment not readily available in the state are attracted to Lincoln National Forest.

Wildfire Exposure Costs

Under the proposed action, the risk of stand-replacing, uncharacteristic wildfire would be reduced as a result of the proposed forest restoration treatments. Approximately 23,280 acres within the project area would be at risk to stand-replacing, uncharacteristic wildfire. If the estimated total cost of wildfire ($1,600 per acre) is applied to the acreage identified as at risk to stand-replacing, uncharacteristic wildfire under the proposed action, the potential exposure cost of wildfire would be $37,248,000.

There is a tradeoff between restoration/fuel reduction treatment costs and potential costs resulting from wildfires when considering the estimated wildfire costs. These costs associated with large wildfires could also be considered avoided costs associated with forest restoration and fuel reduction projects (Bagdon and Huang 2016).

Furthermore, the proportion of the Forest Service's annual budget allocated to wildfire suppression increased from 16 percent in 1995 to 52 percent in 2015, and is projected to increase to 67 percent of the budget by 2025 (U.S. Forest Service 2015c). This means the increased proportion of the Forest Service's budget for wildland fire expenditures has detracted from all non-fire programs and hindered the Forest Service's ability to implement more forest restoration and wildfire risk reduction treatments (U.S. Forest Service 2014d). The 2014 Forest Service report titled *Fire Transfer Impact by State* (U.S. Forest Service 2014d) identifies examples of how funding for local wildfire preparedness, forest restoration, and other activities in nearly every state across the country has been used to instead fight fires when wildfire suppression budgets did not fully cover firefighting costs. For example, in 2012 and 2013, funds were diverted from infrastructure improvements, trail maintenance projects, and hazardous fuels reduction treatments. Administration of permitted special uses was reduced, time needed to complete other National Environmental Policy Act compliance responsibilities was diverted, and resource surveys needed for other proposed projects were delayed (U.S. Forest Service 2014d). The proposed action would work to avoid diverted funds to wildfire suppression by reducing the number of acres highly susceptible to catastrophic wildfire events.

Environmental Justice

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. Based on the minority status and poverty-level figures presented in Table 3-54 and Table 3-55, the communities of Mescalero and Timberon can be considered environmental justice communities near the project area. The proposed action would not reduce employment and income relative to current conditions; therefore, no disproportionate adverse economic effects would occur.

There is the potential for adverse impacts to low-income and/or minority communities due to smoke from prescribed fires. The areas most at risk are Weed, Cloudcroft, Timberon, Mayhill, Alamogordo, Tularosa, and Mescalero. Smoke would travel down the drainages into the 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. These impacts would be short term, lasting 5 to 7 days or the length of the prescribed burn activity. Similarly, smoke from an uncharacteristically severe wildfire would likely affect all residents and visitors living near the wildfire area, often for several weeks or longer. No alternative eliminates fire on the forests; smoke from wildfires could occur regardless of chosen alternative.

The use of smoke reduction techniques and mitigation measures described in the proposed resource protection measures and identified in implementation-level burn plans 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 local communities for any length of time. Mitigation measures also include notification of potentially affected communities before and during prescribed fire treatments. This project would result in no disproportionate impact from smoke to low-income or minority populations in Otero County. Please see the air quality specialist report for more discussion on prescribed fire management and smoke.

Social and Non-market Values

The Forest Service would be taking proactive steps in forest management and restoration, which in turn has beneficial impacts to non-market values. The proposed action is intended to improve community resiliency in addition to forest health. Based on the economic analysis presented above, it is evident that the project would result in increased federal expenditures within Otero County as well as increased contracting opportunities for the forest product industry. Local communities would be beneficially impacted by direct and indirect revenue from the project, either through direct receipt of timber or stewardship contracts or through spending by employed individuals who work on the project. This revenue could help local communities increase their resiliency to changing economic conditions over the 20-year project duration.

During implementation of restoration treatments, roads closures could restrict access for general forest users and visitors, and could affect access to inholdings, grazing allotments, recreation and hunting activities, and firewood collection. The Forest Service has identified several resource protection measures to communicate the temporary closures to the public, permittees, utility companies, and stakeholders with the goal of minimizing potential adverse impacts from temporary closures. Proposed treatment activities would be coordinated with potentially affected adjacent landowners, range allotment permittees, special use permittees, and any other permit holders as needed to minimize access impacts. Any adverse impacts from closures would be short term and limited to a localized area.

Specific to recreational use, coordinated efforts would be made with sponsors of recreational special-use events (i.e., running or mountain biking races) to minimize the impacts on such events within proposed treatment areas during implementation. Alternative locations would be identified to meet the needs of the special-use event if forest management activities conflict with preferred locations and cannot be resolved through timing. Some individuals may not be able to recreate at their preferred sites periodically during the treatment period. If these individuals engage in substitute behavior (e.g., recreating at a different site in the local area), there would be no impact to visitor spending.

However, there are social and non-market economic consequences to recreation displacement. Individuals may get less fulfillment or enjoyment from recreating at an alternate site, which would temporarily adversely affect recreation experience. Revenue from visitation to the project area may be temporarily reduced; however, it is likely that other portions of the Lincoln National Forest could be visited for similar visitor experiences. Because of the temporary nature of the proposed treatment activities and size of discrete treatment areas, compared with the larger Lincoln National Forest, the quality of life implications of recreation displacement would be small.

Summary of Direct and Indirect Effects

Table 3-63 summarizes the economic impacts from the proposed action. Implementation of the proposed action would result in substantial treatment costs to the Forest Service, ranging from an estimated $18 million to $76 million over the 20-year project duration. Approximately $750,000 in timber sale revenue is estimated for the project over 20 years. Approximately 230,000 CCF of timber would be removed from the project area over the life of the project, and approximately 75 to 200 jobs would be supported annually. Stand-replacing, uncharacteristic wildfire exposure costs are estimated at $37,248,000. No disproportionate impacts to minority or low-income populations are expected from the proposed action.

Table 3-63. Resource Indicators and Measures for Alternative 2 Direct/Indirect Effects

Resource Element	Resource Indicator (quantify if possible)	Measure (quantify if possible)	Alternative 2 Direct/Indirect Effects
Economics	Treatment costs	Sum of survey cost, sale preparation costs, sale administrative costs, road costs, prescribed burning costs	$18,612,400 to $76,153,400
Economics	Timber value	Dollars	$751,739 over 20 years
Economics	Total production of forest products	100 cubic feet (CCF) removed	230,197 CCF over 20 years
Economics	Potential jobs created	Number of jobs	75 to 200 annually
Economics	Wildfire Exposure Costs	Dollars	$37,248,000
Environmental Justice	Impacts to minority and low-income communities	Disproportionate adverse impacts	None

Cumulative Effects

See Table 3-1 for a list of past, ongoing, and reasonably foreseeable future actions considered for cumulative effects on social and economic resources.

The area of consideration for cumulative effects of the action alternatives is Otero County, including the communities of Weed, Cloudcroft, Timberon, Mayhill, Alamogordo, Tularosa, and Mescalero. Most of the social and economic effects discussed would be expected to occur within this county.

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. Restoration activities would occur on adjacent public lands, including the Rio Peñasco Two Project, Jim Lewis Fuel Reduction Project, Two Goats Restoration Project, and the Westside Watershed Restoration Project restoration treatments, which would also increase ecosystem resilience in the Sacramento Mountains. Combined, these projects would treat up to approximately 94,000 acres over the next decade. Mechanical treatments and other restoration activities on the adjacent state lands and tribal lands would further increase economic benefits from timber removal and job opportunities. There would also be subsequent cumulative social and non-market values benefits to local communities, such as improved ecosystem services, reduced wildfire risk, and an improved perception of public land management; these would contribute to community resilience.

Because of the small windows of opportunity for burning that typically exist in the Sacramento Mountains, it is possible that the federal, state, and local landowners 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. Fire hazard would be further reduced throughout the area.

3.12.4 Forest Plan Amendments

The Forest Plan amendment that would allow mechanized equipment to be used on slopes greater than 40 percent in the project area to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives would result in beneficial impacts to social and economic conditions in the study area. Allowing treatment to occur on steeper slopes would provide access to timber that otherwise would not be removed from National Forest System lands. Increased revenue to the federal government and increased income to contractors would be expected as a result of this proposed Forest Plan amendment.

Similarly, the proposed amendments allowing forest restoration treatments to occur in Mexican spotted owl protected activity centers would result in beneficial impacts to social and economic conditions because timber in these areas would not be available for removal without the amendment. Increased revenue to the federal government and increased income to contractors would be expected as a result of this proposed Forest Plan amendment. There is also a potential for forest restoration treatment costs to decline over time as larger areas would be available for treatment. With additional areas available for treatment in Mexican spotted owl protected activity centers, the marginal costs to contractors of treating additional acres could decrease.

With these amendments for treatments on slopes greater than 40 percent and allowing forest restoration treatments within protected activity centers in place, the risk of an uncharacteristically severe wildfire would be reduced. Low-income and minority populations would not be disproportionately affected by the proposed amendments.

Conclusion

Table 2-14 summarizes the impacts to economic and social conditions from the no action alternative and proposed action. The proposed action would result in beneficial social and economic impacts over the 20 year life of the project. The benefits include increased jobs, federal spending, timber revenues, and income.

3.13 Summary

3.13.1 Degree to Which the Purpose of and Need for Action Is Met

The purpose and need states several reasons for conducting the project, including to “increase forest resiliency to insects, disease, and climate change by shifting forest structure, composition, and diversity toward desired conditions and, reduce high-severity fire risks and post-fire flooding potential to protect life, property, and natural resources by reducing the acres currently classified as having high, very high, and extreme crown fire hazard potential across the project area.” Research suggests that forests that are thinned and treated with prescribed fire are considerably more resilient to large-scale disturbances that are likely to result from the forecasted warmer, drier climate than those that have no had treatment and instead have had uncharacteristically severe wildfires.

The proposed action would move vegetation communities closer to historic conditions, returning historic fire regimes to fire-adapted vegetation and reducing the risk of uncharacteristic catastrophic wildfire that impacts long-term woodland and forest health and threatens life, property, community values, and critical infrastructure. By altering stand structure and favoring larger, healthier trees, the incidence of insect and disease would be reduced across all vegetation types. By improving individual tree vigor and creating a more diverse age and size class structure within and between stands, native vegetation communities would move closer to desired conditions, improving ecosystem functioning.

The proposed action would also help improve watershed function where impaired, as well as improve soil condition and productivity, hydrologic function of springs and seeps, and quality of perennial and intermittent waters and riparian areas through the proposed restoration methods. Restored forests also contribute to improved air quality, as they are more resilient to large-scale wildfire that adversely impact the airshed.

The proposed action would result in improved forest health and watershed function, which would also improve ecosystem services, such as clean air and water, provided to local communities. By ensuring resilient ecosystems, the Forest Service can help to sustain local economic and social well-being, promote a sustainable flow of societal benefits, and manage multiple uses over the long term, so that these lands provide enduring ecosystem services and contribute to social and economic stability, as well. The proposed action would allow for beneficial economic impacts such as jobs, federal spending, timber revenues, and income to be recognized by the local communities within Otero County. By mitigating the potential for uncharacteristic wildfire, the proposed action also provides the best alternative for the protection of heritage resources, because this action will help to reduce the fuel loading within and near heritage resources and will help to reduce the intensity of wildfires.

During implementation of vegetation treatments, roads closures could restrict access for general forest users and visitors, and could affect access to inholdings, grazing allotments, recreation and hunting activities, and firewood collection. Because restoration activities would never occur across the entire project area at one time, and because of resource protection measures intended to minimize impacts for recreation, infrastructure, and inventoried roadless areas, road closures would be a minor, site-specific impact.

3.13.2 Summary of Environmental Effects

Table 2-14 in Chapter 2 summarizes the potential impacts to resources analyzed in Chapter 3 for the No Action Alternative and Proposed Action. Impacts of the proposed amendment on the substantive 2012 Planning Rule requirements (36 CFR 219.8 through 219.11) are discussed in Appendix A.

3.14 Other Mandatory Disclosures

3.14.1 Short-term Uses and Long-term Productivity

The National Environmental Policy Act requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). As declared by Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (National Environmental Policy Act Section 101).

Implementation of the proposed action does not jeopardize the long-term productivity of the Lincoln National Forest. As described above, implementing the proposed action would reduce the risk of catastrophic wildfire while increasing ecosystem resiliency to natural disturbance. Disturbance from vegetation treatments, prescribed fire, and other restoration activities would have short-term adverse impacts to many of the resources analyzed in this environmental impact statement; however, these treatments would not result in long-term adverse impacts to productivity due to the resource protection measures in place. For many resources, the proposed action would move the resource closer to desired conditions and ensure the resource is sustainable for future generations.

3.14.2 Unavoidable Adverse Effects

Vegetation Communities, Fire and Fuels

Given the mitigation measures included with the proposed action, no long-term adverse impacts to vegetation communities, fire and fuels resources are expected from the project. Short-term adverse impacts that cannot be avoided would be temporary loss of individual vegetation and alteration of species composition as a result of mechanical treatments, prescribed burning, and wildfire events, but long-term impacts on vegetation communities would be mitigated through the application of the resource protection measures.

Soils, Hydrology, Watersheds

Given the mitigation measures included with the proposed action, no long-term adverse impacts to soil and watershed resources are expected from the project. Short-term adverse impacts that cannot be avoided would be potential loss of surface cover from mechanical treatments, prescribed burning, and wildfire events, but will be mitigated through the application of the resource protection measures.

Threatened and Endangered Species and Other Wildlife

Implementation of the proposed action would have adverse effects on individual neo-tropical migratory birds because burning and tree-cutting activities implemented during the nesting and breeding season could destroy active nests in trees that are cut; disrupt breeding, foraging, and other behaviors; or displace individuals. While there could be loss of individuals, the proposed action is not expected to cause a downward trend to statewide population levels for neo-tropical migratory birds. The proposed action will have unavoidable impacts to listed species, such as the Mexican spotted owl, due to the treatment being proposed during the breeding season. However, through monitoring and adaptive management, impacts to listed species will be minimized as data become available and analyzed for future treatments.

Air Quality and Climate

Short-term adverse effects on the visibility of nearby Class I areas are expected. These effects are unavoidable but post-treatment conditions would reduce the long-term risk of large wildfires, which could compromise visibility in Class I Areas for a longer duration of time.

Scenery and Visual Quality

Surface-disturbing and restoration activities unavoidably would change the characteristic landscape, scenic quality, and scenic benefits in the project area. Vegetation removal either through thinning or prescribed fire could be considered an adverse effect, as bare ground, skid trail scars, slash piles, and smoke would negatively alter the visual resources. However, to bring about a healthier ecosystem, which in turn benefits scenery resources and visitors, this is unavoidable. The sight of restoration equipment and activities would also adversely impact the scenery; however, as with vegetation removal, these are temporary impacts and would be localized.

Recreation, Infrastructure, and Inventoried Roadless Areas

The noise, sight, and presence of restoration equipment and workers (considered an unavoidable impact) could temporarily disturb the recreation setting (particularly in areas classified as recreation opportunity spectrum semi-primitive motorized and semi-primitive non-motorized), and, depending upon the activity, recreation opportunity (e.g., hunting and/or recreationists seeking solitude, quiet, and undeveloped forest areas). These adverse and unavoidable impacts would be temporary, short term, and localized (i.e., site specific), occurring only when restoration activities are being implemented on the ground. Additionally, smoke from prescribed burns would be considered unavoidable, could also disturb the recreation setting and recreation opportunity, and would also be short term, temporary, and site specific.

3.14.3 Irreversible and Irretrievable Commitments of Resources

An irreversible commitment of a resource is one that cannot be regained, such as the extinction of a species. An irretrievable commitment is one where the value of the resource is lost for a period of time, such as the loss of soil productivity.

Under the proposed action, irreversible and irretrievable commitment of resources would result from the construction of any new permanent, Maintenance Level 1 roads, which would cause a permanent loss of habitat and soil resources. Road construction could cause irreversible and irretrievable impacts to soil productivity and habitat loss that cannot be recovered as long as the roads remain in place.
The overall impact is expected to be minor because the need for new permanent road access during implementation is expected to be minimal. The project area would largely be accessed through the existing road system or through the construction of temporary roads extending up to 0.5 mile from the existing road system. Any temporary roads would be rehabilitated after treatments are completed according to the resource protection measures.

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Chapter 4 Consultation and Coordination

4.1 Preparers and Contributors

Members of the Interdisciplinary team are listed in Table 4-1.

Table 4-1. Interdisciplinary Team Members

Name	Agency	Title
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4.2 Federal, State, Local Agencies Consulted

U.S. Fish and Wildlife Service

New Mexico Department of Game and Fish

South Sacramento Restoration Project Collaboration Group

4.3 Tribes Consulted

Mescalero Apache Tribe

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Chapter 6 Glossary

Adaptive management: 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.

Age class: a distinct aggregation (grouping) of trees originating from a single natural event or regeneration activity commonly consisting of trees of similar age.

Aspect: the direction in which a slope faces.

Basal area: the area of a cross-section of a tree, including bark, at breast height (4.5 feet above ground level). 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.

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.

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.

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 archaeological sites, or along each side of a stream, or near other features to be protected from human disturbance.

Burn severity: a qualitative assessment of the heat pulse directed toward the ground during a fire. Burn severity relates to soil heating, large fuel and duff consumption, consumption of the litter and organic layer beneath trees and isolated shrubs, and mortality of buried plant parts.

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 base height: the vertical distance from the lowest live branch or whorl on a tree to the ground.

Canopy bulk density: the measure of the density of available canopy fuels, which reflects the likelihood that fire can move through the forest canopy.

Canopy cover or closure (percent): Canopy closure and canopy cover are two slightly different measures of the forest canopy that determine the amount of light able to penetrate to the forest floor. Canopy cover is the percentage of a given ground area that is covered by the vertical projection of the crowns of trees. Canopy or crown closure is an integrated measure from multiple angles of the canopy over a segment of the sky (hemisphere) above a single point on the ground. Both estimate the amount that tree canopies interlock and cover the ground surface with shade.

CCF: abbreviation signifying 100 cubic feet of wood volume.

Characteristic landscape: description of the aesthetic, social, and biophysical attributes that give a place its identity.

Class I areas (Air Quality): geographic areas designed by the Clean Air Act subject to the most stringent restrictions on allowable increment of air quality deterioration. Class I areas include Forest Service wildernesses and nation memorial parks over 5,000 acres, National Parks exceeding 6,000 acres, international parks, as well as other designated lands.

Closed road: a road placed in storage between intermittent uses. A closed road is closed to all vehicular traffic but may be available and suitable for nonmotorized uses. A closed road may be opened again for use at some time in the future.

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.

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.

Conservation measure: a mitigation measure developed by the U.S. Fish and Wildlife Service designed to address effects on wildlife.

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.

Cover type: refers to a forest or woodland type, such as ponderosa pine, pine-oak, or mixed-conifer.

Critical habitat: refers to specific geographic areas that are essential for the conservation of a federally listed threatened or endangered species and that may require special management and protection.

Crown: the portion of an individual tree above the main stem, consisting of live branches and foliage.

Crown cover: the ground area covered by the crown of a tree as delimited by the vertical projection of its outermost perimeter.

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.

Crowning index: the minimum wind speed (an index of rate of spread) required to maintain crown fire activity.

Desired condition: a portrayal of the land and resource conditions that are expected to result if goals and objectives are fully achieved. These conditions may currently exist or may be achieved sometime in the future. Desired conditions may be based on ecological or social objectives, or both. Desired ecological conditions are typically based upon the concepts of ecosystem structural and functional sustainability, resilience, and adaptive capability.

Diameter at breast height (DBH): a standard measure of tree diameter measured approximately 1.5 meters (4.5 feet) above the ground.

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.

Drought: a period of relatively long duration with substantially below-normal precipitation, usually occurring over a large area.

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 response unit: technical groupings of finer vegetation classes with similar site potential and disturbance history.

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.

Ecosystem: a complex of interacting organisms (plants, animals, fungi, bacteria, etc.) together with its environment, considered as a unit.

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: a species in danger of extinction throughout all or a significant portion of its range.

Ephemeral waterbody: a stream that flows only briefly during and following a period of rainfall in the immediate vicinity.

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 about 20 percent of rotation age.

Extreme fire behavior: extreme implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One or more of the following is usually involved: high rate of spread, prolific crowning and/or spotting, presence of fire whirls, strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

Felling: the cutting of standing trees.

Fine fuels: fast-drying fuels usually less than 0.25 inch in diameter and having a time lag of 1 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.

Fire behavior: the manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire frequency: a general term referring to the recurrence of fire in a given area over time.

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 Management Plan: a plan that identifies and integrates all wildland fire management and related activities within the context of approved land/resource management plans. A Fire Management Plan defines a program to manage wildland fires (wildfire and prescribed fire). The plan is supplemented by operational plans, including but not limited to preparedness plans, preplanned dispatch plans, prescribed fire burn plans, and prevention plans. Fire Management Plans ensure that wildland fire management goals and components are coordinated.

Fire Management Unit: a land area definable by specified management objectives, constraints, topographic features, access, values to be protected, political boundaries, fuel types, major fire regime groups, and other defined elements that set it apart from an adjacent area. The primary purpose of developing Fire Management Units in fire management planning is to assist in organizing information in complex landscapes. A Fire Management Unit may have dominant management objectives and preselected strategies assigned to accomplish these objectives.

Fire prevention: activities such as public education, community outreach, law enforcement, engineering, and reduction of fuel hazards that are intended to reduce the incidence of unwanted human-caused wildfires and the risks they pose to life, property, or resources.

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: a measure of the degree of departure (gap) between existing conditions and reference conditions in relation to fire regimes.

Fire resources: all personnel and equipment available or potentially available for assignment to incidents.

Fire return interval: the number of years between two successive fires in a designated area.

Fire severity: a term related to the environmental impacts caused by a fire.

Fire suppression: all work and activities connected with control and fire-extinguishing operations, beginning with discovery and continuing until the fire is completely extinguished.

Flame length: the height of flames from a wildfire or prescribed fire, above the ground surface.

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 health: the perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance. Note perception and interpretation of forest health are influenced by individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of the stands that comprise the forest, and the appearance of the forest at a point in time.

Free thinning: the removal of trees to control stand spacing and favor desired trees, using a combination of thinning criteria without regard to crown position.

Fuel: combustible living and dead material including vegetation such as trees, shrubs, grasses, snags, downed logs, tree needles, and other leaf litter that feeds a fire.

Fuel break: a natural or human-made change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled.

Fuel loading: the amount of fuel present expressed quantitatively in terms of weight of fuel per unit area. This may be available fuel (consumable fuel) or total fuel and is usually dry weight.

Fuel management: act or practice of controlling flammability and reducing resistance to control of wildland fuels through mechanical, chemical, biological, or manual means, or by fire, in support of land management objectives.

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 treatment: manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control (e.g., lopping, chipping, crushing, piling and burning).

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 down trees. Gap formation is an important aspect of change and regeneration in many forests.

GIS (geographic information system): computer program(s) 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.

Grade control structure: an earthen, wooden, concrete, or other type of structure built across a drainage that prevents gully erosion.

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 at 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.

Group selection: a cutting procedure which creates a new age class by removing trees in groups or patches to allow seedlings to become established in the new opening.

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.

Hand thinning: the use of hand tools such as chainsaws, brush cutters, loppers, and other methods that do not require the use of heavy machinery, vehicles, or similar equipment.

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.

Hazard: any real or potential condition that can cause injury, illness, or death of personnel, or damage to or loss of equipment or property.

Heavy fuels: fuels of large diameter such as snags, logs, and large limbwood, which ignite and are consumed more slowly than flash fuels. Also called coarse fuels.

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.

Hydrophobicity: resistance to wetting exhibited by some soils, also called water repellency. The phenomenon may occur naturally or may be fire-induced. It may be determined by water drop penetration time, equilibrium liquid-contact angles, solid-air surface tension indices, or the characterization of dynamic wetting angles during infiltration.

Intermittent waterbody: a stream in which the flow of water on the surface is discontinuous, or that alternates between zones of surface and subsurface flow.

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.

Jackpot burn: a modified form of broadcast burning where the target fuels are in concentrated pockets but not piled.

Jurisdiction: the range or sphere of authority. Public agencies have jurisdiction at an incident related to their legal responsibilities and authority for incident mitigation. Jurisdictional authority at an incident can be political/geographical (e.g., city, county, state or federal boundary lines), or functional (e.g., police department, health department, etc.).

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.

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.

Log: section of the main stem of a harvested tree.

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 chainsaws, feller-bunchers, and skidders.

Mitigation measure: an activity or limitation placed upon a project activity to avoid or minimize adverse effects.

Model: a simplified or generalized representation of reality; a description, analogy, picture, or hypothesis to help visualize something that cannot be directly observed.

Monitoring: physical and biological evaluation of project activities to determine how well objectives are being met and if the effects of the activities are within those projected during the analysis.

Monoculture: the cultivation or growth of a single crop or organism, especially on agricultural or forest land.

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.

Non-market values: the benefits and values associated with National Forests that do not have a monetary price, including clean water and air, biodiversity, forest products, and other goods and services. Also referred to as ecosystem services.

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.

Nutrient cycling: the circulation of chemicals necessary for life, from the environment (mostly from soil and water) through organisms and back to the environment.

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.

Openings: spatial breaks between groups or patches of trees containing grass, forb, shrub, and/or tree seedlings, but that are largely devoid of big trees.

Organic matter: that fraction of the soil that includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population.

Overstocked: a condition 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 waterbody: a stream that flows throughout most (greater than 50 percent) of the year.

Pile burning: activity fuels, once piled by machine or by hand, are burned in place.

PM2.5: particulate matter of mass median aerodynamic diameter (MMAD) less than or equal to 2.5 micrometers.

PM10: particulate matter of mass median aerodynamic diameter (MMAD) less than or equal to 10 micrometers.

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 activity center: an area that is a minimum of 600 acres surrounding known owl nest/roost sites. Protected activity centers are intended to sustain and enhance areas that are presently, recently, or historically occupied by breeding Mexican spotted owls.

Rate of spread: the relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.

Recreation opportunity spectrum: a classification system that describes different outdoor recreation settings across the forests using seven standard classes that range from primitive, undeveloped settings to urban, highly developed settings. Attributes typically considered in describing the settings are size, scenic quality, type, and degree of access, remoteness, level of development, social encounters, and the amount of on-site management.

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.

Residence time: the time, in seconds, required for the flaming front of a fire to pass a stationary point at the surface of the fuel. The total length of time that the flaming front of the fire occupies one point.

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.

Resource protection measures: a list of management actions designed to guide implementation of on-the-ground activities to achieve desired conditions while minimizing adverse effects. Resource protection measures guide 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.

Restoration: the process of returning ecosystems or habitats to desired structure and species composition.

Riparian: the land and vegetation bordering flowing or standing water, identified by distinctive saturated soil characteristics and vegetation that require water (streams, lakes, ponds).

Risk: 1) the chance of fire starting as determined by the presence and activity of causative agents; 2) a chance of suffering harm or loss; 3) a causative agent; 4) in the National Fire Protection Association Standards, a number related to the potential of firebrands to which a given area will be exposed during the rating day.

Road decommissioning: activities that result in the stabilization and restoration of unneeded roads to a more natural state.

Road maintenance levels: level of service provided by, and maintenance required for, a specific system road, consistent with road management objectives and maintenance criteria. There are five levels:

> **Level 1:** 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 with aggregate surface.
>
> **Level 5:** Assigned to roads that provide a high degree of user comfort and convenience. These roads are normally double lane, paved facilities.

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.

Sapling: a tree that is no longer a seedling but not yet a pole, usually at least 4.5 feet tall and 1.0 to 4.9 inches in diameter.

Sawtimber: trees, or logs cut from trees, with suitable diameter and stem quality for conversion to lumber.

Sedimentation: the filling-in of stream channels or waterbodies 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.

Severity: the quality or state of distress inflicted by a force. The degree of environmental change caused by a disturbance (e.g., fire).

Shade-intolerant species: species that require sunlight to establish and grow.

Shade-tolerant species: species that 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.

Skyline yarding: a thinning method that uses a system of cables to drag logs or whole trees from the cutting unit to a roadside landing.

Slash: branches, treetops, bark, and other woody material left on the ground as a byproduct of thinning (activity-produced slash).

Slope percent: the ratio between the amount of vertical rise of a slope and horizontal distance as expressed in a percent. For example, 100 feet of rise to 100 feet of horizontal distance equals 100 percent.

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.

Soil stability: the potential of soil-covered slopes to withstand and undergo movement.

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: 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.

State and transition model: nonequilibrium ecological model to describe vegetation dynamics of rangeland sites as adopted by the Natural Resources Conservation Service. Models recognize multiple steady states of vegetation and emphasize disturbance processes.

Structural stage: a stage of development of a vegetation community that is classified on the dominant processes of growth, development, competition, and mortality.

Succession: the ecological process of sequential replacement by plant communities on a given site as a result of reproduction and competition. The different stages of succession are often referred to as seral stages. Developmental stages are as follows:

> **early seral:** Communities that occur early in the successional path and generally have less complex structural developmental than other successional communities. Seedling and sapling size classes are an example of early seral forests.
>
> **mid-seral:** Communities that occur in the middle of the successional path. For forests, this usually corresponds to the pole or medium sawtimber growth stages.
>
> **late seral:** Communities that occur in the later stage of the successional path with mature, generally larger individuals, such as mature forests.

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.

Suppression: a wildfire response strategy to "put the fire out" as efficiently and effectively as possible, while providing for firefighter and public safety. Also known as "perimeter containment" and "control." The goal of this strategy is to minimize acres burned.

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: for this environmental impact statement, the capacity of an ecosystem for long-term maintenance of ecological processes and functions, biological diversity, and productivity.

System road: roads under the jurisdiction of the Forest Service and necessary for protection, administration, and use of the National Forests.

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.

Thin 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."

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.

Threatened: a species 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.

Torching index: the open (6.1-m) windspeed at which crown fire activity can initiate for the specified fire environment**.**

Treatment: any silvicultural practice or procedure.

Understory: trees and other vegetation that grow 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.

Values at risk: property, structures, physical improvements, natural and cultural resources, community infrastructure, and economic, environmental, and social values.

Vegetation Structural Stages: a method for describing the growth stages of a stand of living trees. VSS are based on tree size (diameter) and total canopy cover. The system is used to group forest cover types into categories of similar growth conditions. There are six classes:

- VSS 1: grass/forb/shrub
- VSS 2: less than 5 inches diameter (seedling-sapling)
- VSS 3: 5 to 12 inches diameter (young forest)
- VSS 4: 12 to 18 inches diameter (mid-aged forest)
- VSS 5: 18 to 24 inches diameter (mature forest)
- VSS 6: greater than 24 inches diameter (old trees)

Wildland fire: a general term describing any non-structure fire that occurs in vegetation or natural fuels. Includes prescribed fire and wildfire.

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.

Water bar: 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.

Water yield: the amount of water “produced” by the watershed, i.e., the difference between precipitation and evapotranspiration.

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.

Wildland-urban interface: the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetation fuels.

Woodland: a forest with low tree densities, often defined as less than 20 to 30 percent crown cover when trees are mature.

Woody debris: the dead and downed material on the forest floor consisting of fallen tree trunks and branches.

APPENDIX A – FOREST PLAN AMENDMENT ANALYSIS

South Sacramento Restoration Project Forest Plan Amendment and 2012 Planning Rule Consistency Review

Introduction

Under the National Forest Management Act and its implementing regulations at 36 Code of Federal Regulations (CFR) 219 (2012 Planning Rule), a plan may be amended at any time. Plan amendments may be broad or narrow, depending on the need for the change. The proposed project-specific amendment includes several modifications to the current Forest Plan standards and guidelines so new controls and technologies can be utilized where appropriate.

The 2012 Planning Rule requires consideration of the applicable substantive requirements as described in 36 CFR 219.8 through 219.11 that are directly related to the plan direction being added, modified, or removed by the amendment (36 CFR 219.13). The responsible official has determined that the proposed amendment is directly related to the following substantive requirements:

- ***§219.8 Sustainability***

  (a)(1)(v) Ecological Sustainability, Ecosystem Integrity, Wildland Fire Opportunities to Restore Fire Adapted Ecosystems;

  (a)(1)(vi) Ecological Sustainability, Ecosystem Integrity, Opportunities for Landscape Scale Restoration;

  (a)(2)(i) Air, Soil, and Water, Air Quality;

  (a)(2)(iii) Air, Soil, and Water, Water Quality;

  (b)(2) Social and Economic Sustainability, Sustainable recreation; including…scenic character;

  (b)(3) Social and Economic Sustainability, Multiple uses that contribute to local, regional, and national economies in a sustainable manner.

- ***§219.9 Diversity of Plant and Animal Communities***

  (a)(1) Ecosystem Plan Components, Ecosystem Integrity;

  (b)(1) Additional Species-Specific Plan Components, Provide the ecological conditions to contribute to the recovery of federally listed threatened and endangered species.

- ***§219.10 Multiple Use***

  (a)(1) Integrated resource management for multiple use, aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, geologic features, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, wilderness, and other relevant resources and uses;

  (a)(9) Integrated resource management for multiple use, public water supplies and associated water quality;

  (b)(1)(i)[I]nclude plan components…to provide for: Sustainable recreation; including…scenic character.

The effects of the proposed amendment are disclosed in Chapter 3 – Environmental Consequences, and were informed using the best available scientific information, scoping, effects analysis, monitoring data, or other rationale.

Scope and Scale of the Amendment

The amendment includes modifications in standards and guidelines that pertain to the prescriptions, levels of management, and allowable uses for vegetation and forestry resources, wildlife, scenery management, fire and fuels, and topographic resources within the project area. Specifically, the amendment includes modifications in the standards and guidelines, as prescribed in the 1986 Lincoln National Forest Plan, as presented in Tables A.1 and A.2.

Table A.1 provides a comprehensive list of all changes to the current Forest Plan that would result from the Plan Amendment being considered as part of the South Sacramento Restoration Project. Table A.2 provides a list of additions to the Forest Plan that would result from the Plan Amendment. Both tables identify the applicable substantive requirement(s) for each proposed Forest Plan modification in the right-hand column of the tables.

Table A.1. Proposed Replacement Text. Language to be added to the Forest Plan is bolded and existing language to be removed is strikethrough.

Section and Page Number	Existing Forest Plan Direction	Amended Forest Plan Direction	Related Substantive Requirement (s)
Management Area 2D[3] Sacramento River Protection (Page 94)	Zone A. Suppression objective 10 acres or less. Use prescribed fire with planned ignition to accomplish resource management objectives.	~~Zone A. Suppression objective 10 acres or less.~~ **Zone C.** ~~Use prescribed fire with planned ignition to accomplish resource management objectives.~~ **Use planned and unplanned ignitions, where feasible and appropriate, to accomplish resource management objectives.**	36 CFR 219.8(a)(1)(v) 36 CFR 219.8(a)(2)(i)
Management Area 4I James/Penasco Protection (Replacement Page 131)	Zone A. Suppression objective 10 acres or less. Use prescribed fire with planned ignition to accomplish resource management objectives.	~~Zone A. Suppression objective 10 acres or less.~~ **Zone C.** ~~Use prescribed fire with planned ignition to accomplish resource management objectives.~~ **Use planned and unplanned ignitions, where feasible and appropriate, to accomplish resource management objectives.**	36 CFR 219.8(a)(1)(v) 36 CFR 219.8(a)(2)(i)
Management Area 4J[4] Upper Agua Chiquita Protection (Page 134)	Zone A. Suppression objective 10 acres or less. Use prescribed fire with planned ignition to accomplish resource management objectives.	~~Zone A. Suppression objective 10 acres or less.~~ **Zone C.** ~~Use prescribed fire with planned ignition to accomplish resource management objectives.~~ **Use planned and unplanned ignitions, where feasible and appropriate, to accomplish resource management objectives.**	36 CFR 219.8(a)(1)(v) 36 CFR 219.8(a)(2)(i)

[3] Management areas 2D and 4I fall entirely within the South Sacramento Restoration Project boundary.

[4] Management Area 4J falls partially in the South Sacramento Restoration Project boundary and partially within the Jim Lewis Project boundary. The Forest Plan was previously amended to allow management of unplanned wildfires for multiple objectives in the portion of the management area within the Jim Lewis Project boundary (Amendment 17). The proposed amendment would extend this policy to cover the rest of the management area, which falls within the South Sacramento Restoration Project boundary. Since the entire management area would be amended to Zone C if Amendment 19 is approved, the amended text would reflect that the wildfire management policy would apply to the entire management area.

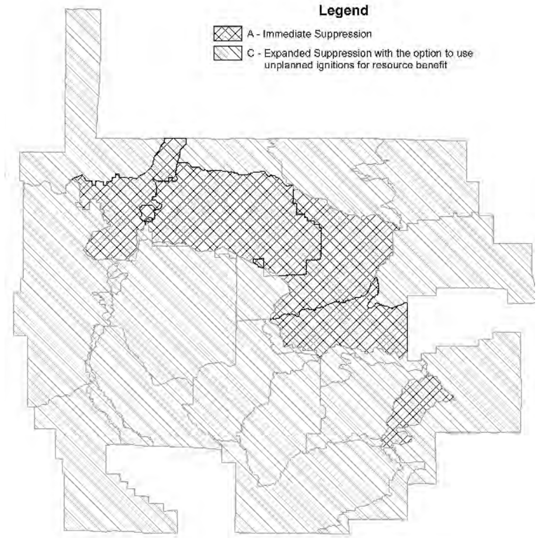
Section and Page Number	Existing Forest Plan Direction	Amended Forest Plan Direction	Related Substantive Requirement (s)
Management Prescriptions Applicable to All Areas Fire and Protection (Replacement Page 51)			36 CFR 219.8(a)(1)(v) 36 CFR 219.8(a)(2)(i)

Table A.2. Proposed Additions. Language to be added to the Forest Plan is bolded.

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Management Prescriptions Applicable to All Areas Recreation (Replacement Page 28)	In retention and partial retention foreground distance zone, activities will be compatible with the natural landscape.	Add the following text after this section: **The South Sacramento Restoration Project area is exempted from meeting retention and partial-retention visual quality objectives (VQOs) until slash disposal treatments and rehabilitation of landings, skid trails, and temporary roads are completed.**	36 CFR 219.8(b)(2) 36 CFR 219.10(a)(1) 36 CFR 219.10(b)(1)(i)
Management Prescriptions Applicable to All Areas Timber (Replacement Page 37)	Use the following guidelines for thinning spruce-fir, mixed conifer and ponderosa pine: a. In the mixed conifer and ponderosa pine types, thin to 200-300 well-spaced acceptable trees per acre using one pre-commercial entry. In the spruce-fir type, thin to 500-600 trees per acre. b. Non-commercial species will be retained if needed for wildlife or other resource purposes, and if not in conflict with timber management objectives; otherwise, non-commercial species over 4 inches DBH will be cut during pre-commercial thinning. c. When timber growth and production is a primary concern, the following ranges of growing stock levels (GSL) will be used. PP Type Mixed Conifer Spruce-fir 50-90 60-120 70-150 The higher GSLs will be used on areas with higher site productivity. GSLs outside of the above ranges, but not to exceed 150 in mixed conifer and 200 in spruce-fir, may be used when other resource considerations have priority.	Add the following text after this section: **The South Sacramento Restoration Project will follow desired conditions guidelines described in General Technical Report RMRS-GTR-310 and the Southwestern Region desired conditions supplement for mixed conifer, ponderosa pine, and pinyon-juniper ecological response units outside of areas designated as Mexican spotted owl protected or recovery habitat. In areas designated as Mexican spotted owl protected or recovery habitat, desired conditions and guidance for the Basin and Range-East Ecological Management Unit from Tables C.1, C.2, and C.3 of the revised Mexican spotted owl recovery plan will be followed.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Management Prescriptions Applicable to All Areas Timber (Replacement Page 38)	Limit wheeled or tracked logging equipment to slopes less than 40 percent.	Add the following text after this section: **Mechanized equipment is allowed on slopes greater than 40 percent in the South Sacramento Restoration Project area to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.8(b)(3) 36 CFR 219.9(a)(1) 36 CFR 219.10(a)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Management Prescriptions Applicable to All Areas Soil and Water (Page 40)	Select treatment methods for plant control or revegetation projects according to the following criteria: a. Mechanical methods may be used: 1. on slopes less than 40 percent, 2. on soils with moderate or high revegetation potential, and 3. when they will not adversely affect stream channels. b. Chemical treatments may be applied: 1. on areas away from municipal watershed and human habitation, 2. on soils with moderate or high revegetation potential, 3. on areas that would benefit from selective control of plant species, 4. on areas where the chemicals will not violate State water quality standards.	Add the bolded text to this section: Select treatment methods for plant control or revegetation projects according to the following criteria: a. Mechanical methods may be used: 1. on slopes less than 40 percent, **Mechanized equipment is allowed on slopes greater than 40 percent in the South Sacramento Restoration Project area to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives,** 2. on soils with moderate or high revegetation potential, and 3. when they will not adversely affect stream channels. b. Chemical treatments may be applied**:** 1. on areas away from municipal watershed and human habitation, **Chemical treatments may be used to control juniper and oak resprouts within municipal watersheds or near areas of human habitation in the South Sacramento Restoration Project area after the public or municipality has been notified,** 2. on soils with moderate or high revegetation potential, 3. on areas that would benefit from selective control of plant species, 4. on areas where the chemicals will not violate State water quality standards.	36 CFR 219.8(a)(1)(vi) 36 CFR 219.8(b)(3) 36 CFR 219.9(a)(1) 36 CFR 219.10(a)(1) 36 CFR 219.8(a)(1)(vi) 36 CFR 219.8(a)(2)(iii) 36 CFR 219.10(a)(9)
Management Prescriptions Applicable to All Areas Fire and Protection (Replacement Page 55)	Use pesticides only when they are the most economical, biologically sound and environmentally acceptable means of preventing or suppressing pest outbreaks which threaten the attainment of objectives.	Add the following text after this section: **In the South Sacramento Restoration Project area, pesticides may be used alone or in combination with other treatment methods where appropriate to meet oak and juniper resprout control objectives.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.8(a)(2)(iii)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Glossary (Pages 173 to Replacement Page 196)	No definitions currently provided for "*interspace*", "*opening*", or "*tree group.*"	Add the bolded text to this section: **Interspace: An area not currently under the vertical projection of the outermost perimeter of tree canopies. They are the spaces between groups of trees (or say, they define tree groups). 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).** **Opening: An area greater than 0.1 acre devoid of trees because it either 1) preclude tree growth (e.g., rock outcroppings, wetlands [natural openings]); 2) was the site of a stand-clearing disturbance event (also natural openings); or 3) was cleared of trees to promote regeneration (regeneration openings). Openings are generally larger than interspaces and should not be confused with interspaces, which are areas between and among trees that are capable of supporting tree growth but, at a given point in time, are absent of tree canopy (typically created and maintained by lower-intensity disturbances [e.g., frequent fire]).** **Tree Group: A cluster of two or more trees with interlocking or nearly interlocking crowns at maturity surrounded by grass-forb-shrub interspaces. Size of tree groups is typically variable depending on forest type and site conditions and can range from fractions of an acre in Ponderosa Pine or Dry Mixed Conifer Forest (i.e., a two-tree group), to many acres, as is common in Wet Mixed-Conifer and Spruce Fir Forests. Trees within groups are typically non-uniformly spaced, and some may be tightly clumped.**	none
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species All Species (Replacement page 205)	Activities likely to cause disturbance, including public use, will be prohibited in the vicinity of any essential habitat for T&E species.	Add the following text after this section: **Activities in the South Sacramento Restoration Project area should integrate habitat management objectives and species protection measures from approved recovery plans and/or other conservation measures as identified through Endangered Species Act Section 7 procedures. Where the Forest Service has entered into signed conservation agreements that provide guidance on activities or actions to be carried out by the Forest, the guidance from the agreement should be followed.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(b)(1)
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species All Species (Replacement page 206)	Prohibit use of pesticides, herbicides or other contaminants harmful to any T&E species present on the project area or areas affecting prey base.	Add the following text after this section: **In the South Sacramento Restoration Project area, pesticides may be used alone or in combination with other treatment methods to meet oak and juniper resprout control objectives as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206A)	Standards: Provide three levels of habitat management -protected, restricted, and other forest and woodland types to achieve a diversity of habitat conditions across the landscape. Restricted areas include all mixed-conifer, pine-oak, and riparian forests outside of protected areas. Other forest and woodland types include all ponderosa pine, spruce-fir, woodland, and aspen forests outside protected and restricted areas.	Add the following text after this section: **For the South Sacramento Restoration Project, desired conditions and guidance for protected and recovery habitat will be followed as described in Tables C.1, C.2, and C.3 of the revised Mexican spotted owl recovery plan or as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206A)	Allow no timber harvest except for fuel wood and fire risk abatement in established protected activity centers. For protected activity centers destroyed by fire, windstorm, or other natural disaster, salvage timber harvest or declassification may be allowed after evaluation on a case-by-case basis in consultation with U.S. Fish and Wildlife Service.	Add the following text after this section: **In the South Sacramento Restoration Project area, timber harvest and other activities may occur in established protected activity centers where appropriate to meet species and habitat recovery goals as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206A)	Allow no timber harvest except for fire risk abatement in mixed conifer and pine-oak forests on slopes greater than 40 percent where timber harvest has not occurred in the last 20 years.	Add the following text after this section: **In the South Sacramento Restoration Project area, timber harvest is allowed on slopes greater than 40 percent to meet forest restoration, wildlife habitat, watershed improvement, and fire hazard reduction objectives as identified through Endangered Species Act Section 7 procedures to meet species and habitat recovery goals.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.8(b)(3) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1) 36 CFR 219.10(a)(1)
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206A)	Limit human activity in protected activity centers during the breeding season.	Add the following text after this section: **Human activities will be limited to no more than two consecutive years in any one protected activity center during the breeding season in the South Sacramento Restoration Project area as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.9(b)(1)
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206C)	Harvest conifers less than 9 inches in diameter only within those protected activity centers treated to abate fire risk as described below.	Add the following text after this section: **The South Sacramento Restoration Project is exempted from diameter harvest limits in areas where Free Thinning of All Tree Sizes or Group Selection with Matrix Thinning is prescribed in protected activity centers as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206C)	In Mexican spotted owl protected activity centers (PAC), vegetation treatments will only be considered after all appropriate NEPA analysis and consultation with the U.S. Fish and Wildlife Service has been completed. When vegetation treatment within a PAC is deemed necessary, the PAC will be monitored for effects of treatment.	<u>Add the following text after this section:</u> **In the South Sacramento Restoration Project area, up to 68 protected activity centers will have vegetation treatments and will be monitored for treatment effects.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206C)	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.	<u>Add the following text after this section:</u> **The South Sacramento Restoration Project is exempted from diameter limits in protected activity centers outside the 100-acre "no treatment" area as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206C)	Use light prescribed burns in non-selected protected activity centers on a case-by-case basis. Burning should avoid a 100-acre "no treatment" area around the activity center. Large woody debris, snags, clumps of broad-leafed woody vegetation should be retained and hardwood trees larger than 10 inches diameter at the root collar.	<u>Add the following text after this section:</u> **In the South Sacramento Restoration Project area, light to moderate-intensity prescribed fires may be used in protected activity centers. Light-intensity prescribed fires are allowed in the 100-acre "no treatment" area.**	36 CFR 219.8(a)(2)(i) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206D)	Use combinations of thinning trees less than 9 inches in diameter, mechanical fuel removal, and prescribed fire.	<u>Add the following text after this section:</u> **The South Sacramento Restoration Project is exempted from diameter limits in protected activity centers as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206D)	C. RESTRICTED AREAS Mixed Conifer and Pine-oak Forests (See glossary definition): Manage to ensure a sustained level of owl nest/roost habitat well distributed across the landscape. Create replacement owl nest/roost habitat where appropriate while providing a diversity of stand conditions across the landscape to ensure habitat for a diversity of prey species. The following table displays the minimum percentage of restricted area that should be managed to have nest/roost characteristics. The minimum mixed conifer restricted area includes 10 percent at 170 basal area and an additional amount of area at 150 basal area. The additional area of 150 basal area is + 10 percent in BR-E and + 15 percent 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.	Add the following text after this section: **Desired conditions and guidance for recovery habitat from Tables C.1, C.2, and C.3 of the revised Mexican spotted owl recovery plan or as identified through Endangered Species Act Section 7 procedures will be followed for the South Sacramento Restoration Project.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
(Continued) Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206D)	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 district-wide or larger landscape analysis shows there is a surplus.		
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206E)	C. RESTRICTED AREAS Save all trees greater than 24 inches DBH.	Add the following text after this section: **The South Sacramento Restoration Project is exempted from diameter harvest limits in areas where Free Thinning of All Tree Sizes or Group Selection with Matrix Thinning is prescribed.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Forest-wide Standards and Guidelines for Federal and State Threatened and Endangered Species Mexican Spotted Owl (Replacement page 206E)	Encourage prescribed and prescribed natural fire to reduce hazardous fuel accumulation. Thinning from below may be desirable or necessary before burning to reduce ladder fuels and the risk of crown fire.	Add the following text after this section: **Free Thinning of All Tree Sizes or Group Selection with Matrix Thinning treatments may also be prescribed to reduce hazardous fuels in the South Sacramento Restoration Project area.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Ecosystem Management in Northern Goshawk Habitat Standards (Replacement Page 208A)	Limit human activity in nesting areas during the breeding season.	Add the following text after this section: **Human activities will be limited to no more than 2 consecutive years in any one post-fledgling family area during the breeding season in the South Sacramento Restoration Project area.**	36 CFR 219.9(a)(1) 36 CFR 219.10(a)(1)
Ecosystem Management in Northern Goshawk Habitat Management Scale	No existing direction	Add the following text to this section: **Where VSS 6 is deficit within the South Sacramento Restoration Project area, all VSS 6 will be maintained regardless of location, except in situations when occasional trees may be removed to provide for understory health and development.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.10(a)(1)
Ecosystem Management in Northern Goshawk Habitat Vegetation Management - Landscape Outside Goshawk Post-fledgling Family Areas (Replacement Page 208C)	Snags are 18 inches or larger DBH and 30 feet or larger in height, downed logs are 12 inches in diameter and at least 8 feet long, woody debris is 3 inches or larger on the forest floor, canopy cover is measured with vertical crown projecting on the average across the landscape.	Add the following text after this section: **For the South Sacramento Restoration Project, canopy cover for mixed conifer and ponderosa pine vegetation types is evaluated based on vertical crown projection for mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass/forb/shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows, grasslands, wetlands, or other areas not managed for forest conditions. Canopy cover estimates will be measured only within tree groups and will exclude interspaces and other areas not managed for forest conditions.**	36 CFR 219.8(a)(1)(iv) 36 CFR 219.9(a)(1)
Ecosystem Management in Northern Goshawk Habitat Vegetation Management - Landscape Outside Goshawk Post-fledgling Family Areas (Replacement Page 208D)	Canopy Cover: Canopy cover guidelines apply only to mid-aged forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass/forbs/shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3).	Add the following text after this section: **For the South Sacramento Restoration Project, canopy cover for mixed conifer and ponderosa pine vegetation types is evaluated based on vertical crown projection for mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass/forb/shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows, grasslands, wetlands, or other areas not managed for forest conditions. Canopy cover estimates will be measured only within tree groups and will exclude interspaces and other areas not managed for forest conditions.**	36 CFR 219.8(a)(1)(iv) 36 CFR 219.9(a)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Ecosystem Management in Northern Goshawk Habitat Vegetation Management - Landscape Outside Goshawk Post-fledgling Family Areas (Replacement Page 208C-208D)	No existing direction	Add the following text to this section: **Provide for the following conditions within the South Sacramento Restoration Project area:** • **Within ponderosa pine stands, manage over time for uneven-aged stand conditions composed of heterogeneous mosaics of tree groups and single trees, with interspaces between tree groups. The size of tree groups, as well as sizes and shapes of interspaces, should be variable.** • **Manage to develop and maintain 20 to 40 percent of the uneven-aged stand as canopy gaps (VSS 1 and VSS 2) and interspaces between tree groups. Interspaces consist of mixtures of grass, forbs, shrubs, scattered single trees, and small areas of nonforested conditions.** • **Tree group spatial distribution may be highly variable based on local site and current conditions; the interspaces between groups may range from 20 to 200 feet, but generally between 40 and 100 feet apart from drip line to adjacent drip line. This spacing of groups is not affected by single trees in the interspaces.** • **Natural meadows, grasslands, savanna grasslands, wetlands, talus slopes, and other non-tree-dominated areas may also occur as inclusions within the general forest; these inclusions will not be managed for forest conditions, and are not included within the uneven-aged stand structure.** • **Over time the spatial location of the tree groups and interspaces may shift within the uneven-aged stand.** • **Each tree group is generally dominated by one vegetation structure stage. The spatial arrangement of trees, high dispersion of VSS structural stage diversity, and interspaces comprise each uneven-aged forest stand. Collectively these stands aggregate to uneven-aged forest landscapes, similar to natural conditions.**	36 CFR 219.8(a)(1)(iv) 36 CFR 219.9(a)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Ecosystem Management in Northern Goshawk Habitat Vegetation Management - Within Post-fledgling Family Areas (Replacement Page 208D)	Spruce-fir: Canopy cover for mid-aged (VSS 3) should average 60+ percent and for old forest (VSS 6) should average 60+ percent. Mixed-conifer: Canopy Cover for mid-aged (VSS 4) to old forest (VSS 6) should be 60+ percent. Ponderosa Pine: Canopy Cover for mid-aged forest (VSS 4) should average /13 60+ percent and 2/3 50+ percent. Mature (VSS 5) and old forest (VSS 6) should average 50+ percent. Woodlands: Maintain existing canopy cover levels.	<u>Add the following text after this section:</u> **For the South Sacramento Restoration Project, canopy cover for mixed conifer and ponderosa pine vegetation types is evaluated based on vertical crown projection for mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass/forb/shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows, grasslands, wetlands, or other areas not managed for forest conditions. Canopy cover estimates will be measured only within tree groups and will exclude interspaces and other areas not managed for forest conditions.**	36 CFR 219.8(a)(1)(iv) 36 CFR 219.9(a)(1)
Ecosystem Management in Northern Goshawk Habitat Vegetation Management - Within Nesting Areas (Replacement Page 208E)	Spruce-fir, mixed-conifer, ponderosa pine cover types: The nesting area contains only mature to old forest (VSS 5 & 6) having a canopy cover (measured vertically) between 50 and 70 percent with mid-aged VSS 6 trees 200 to 300 years old. Non-uniform spacing of trees and clumpiness is desirable. Woodlands: Maintain existing canopy cover levels.	<u>Add the following text after this section:</u> **For the South Sacramento Restoration Project, canopy cover for mixed conifer and ponderosa pine vegetation types is evaluated based on vertical crown projection for mid-aged to old forest structural stages (VSS 4, VSS 5, and VSS 6) and not to grass/forb/shrub to young forest structural stages (VSS 1, VSS 2, and VSS 3) or in interspaces, natural meadows, grasslands, wetlands, or other areas not managed for forest conditions. Canopy cover estimates will be measured only within tree groups and will exclude interspaces and other areas not managed for forest conditions.**	36 CFR 219.8(a)(1)(iv) 36 CFR 219.9(a)(1)
Ecosystem Management in Northern Goshawk Habitat Human Disturbance (Replacement Page 208E)	Limit human disturbance in or near nest sites and post-fledgling family areas during the breeding season so that goshawk reproductive success in not affected by human activity.	<u>Add the following text after this section:</u> **Human activities will be limited to no more than 2 consecutive years in any one post-fledgling family area during the breeding season in the South Sacramento Restoration Project area.**	36 CFR 219.9(a)(1) 36 CFR 219.10(a)(1)
Mexican Spotted Owl (Replacement Page 208H)	B. Protected Areas -Harvest conifers less than 9 inches in diameter only within those protected activity centers treated to abate fife risk as described below.	<u>Add the following text after this section:</u> **The South Sacramento Restoration Project is exempted from diameter harvest limits in areas where Free Thinning of All Tree Sizes or Group Selection with Matrix Thinning is prescribed in protected activity centers as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Mexican Spotted Owl (Replacement Page 208H)	Treat fuel accumulations to abate fire risk: 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.	<u>Add the following text after this section:</u> **The South Sacramento Restoration Project is exempted from diameter limits in protected activity centers outside the 100-acre “no treatment” area as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
Mexican Spotted Owl (Replacement Page 208H)	-Select and treat additional protected activity centers in 10 percent increments if monitoring of the initial sample shows there were no negative impacts or there were negative impacts which can be mitigated by modifying treatment methods.	Add the following text after this section: **Up to 68 protected activity centers may be treated in the South Sacramento Restoration Project area. Paired protected activity centers will be selected as controls as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Mexican Spotted Owl (Replacement Page 208H)	-Use light prescribed burns in nonselected protected activity centers on a case-by-case basis. Burning should avoid a 100-acre "no treatment" area around the activity center. Large woody debris, snags, clumps of broad-leafed woody vegetation should be retained and hardwood trees larger than 10 inches diameter at the root collar.	Add the following text after this section: **In the South Sacramento Restoration Project area, light- to moderate-intensity prescribed fires may be used in protected activity centers. Light-intensity prescribed fires are allowed in the 100-acre “no treatment” area.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.8(a)(2)(i) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Mexican Spotted Owl (Replacement Page 208H)	.Use combinations of thinning trees less than 9 inches in diameter, mechanical fuel removal, and prescribed fire.	Add the following text after this section: **The South Sacramento Restoration Project is exempted from diameter limits in protected activity centers as identified through Endangered Species Act Section 7 procedures.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Mexican Spotted Owl (Replacement Page 208I)	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 percent at 170 basal area and an additional amount of area at 150 basal area. The additional area of 150 basal area is +10 percent in ER-E and +15 percent 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 district-wide or larger landscape analysis shows there is a surplus.	Add the following text after this section: **Desired conditions and guidance from Tables C.1, C.2, and C.3 of the revised Mexican spotted owl recovery plan will be followed for the South Sacramento Restoration Project.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)

Section and Page Number	Existing Forest Plan Direction	New Forest Plan Direction	Related Substantive Requirement
exican Spotted Owl (Replacement Page 208I)	Save all trees greater than 24 inches DBH.	Add the following text after this section: **The South Sacramento Restoration Project is exempted from diameter harvest limits in areas where Free Thinning of All Tree Sizes or Group Selection with Matrix Thinning is prescribed.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)
Mexican Spotted Owl (Replacement Page 208I)	Encourage prescribed and prescribed natural fire to reduce hazardous fuel accumulation. Thinning from below may be desirable or necessary before burning to reduce ladder fuels and the risk of crown fire.	Add the following text after this section: **Free Thinning of All Tree Sizes or Group Selection with Matrix Thinning treatments may also be prescribed to reduce hazardous fuels in the South Sacramento Restoration Project area.**	36 CFR 219.8(a)(1)(vi) 36 CFR 219.9(a)(1) 36 CFR 219.9(b)(1)

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Evaluation of Substantive Requirements

To ensure the proposed Forest Plan amendment is consistent with the substantive requirements outlined in the 2012 Planning Rule, each proposed modification to the Forest Plan was evaluated against the criteria outlined in 36 CFR 219.8 through 219.10. The proposed modifications to the Forest Plan would not result in substantial adverse effects to the timber substantive requirements listed under 36 CFR 219.11.

36 CFR 219.8 Sustainability (Ecological and Social/Economic)

Per 36 CFR 219.8, "a plan developed or revised under this part must provide for social, economic, and ecological sustainability within Forest Service authority and consistent with the inherent capability of the plan area…". Specifically, the activities that would be authorized by the amendment could potentially influence protections for:

a) ecological sustainability including ecosystem integrity to include structure, function, composition, and connectivity of terrestrial and aquatic ecosystems and watersheds; air quality; and water quality and resources; and

b) social and economic sustainability to include scenic character; and multiple uses that contribute to local and regional economies.

As stated in 36 CFR 218.8(a)(vi), "the plan must include plan components, including standards and guidelines, to maintain or restore the ecological integrity of terrestrial and aquatic ecosystems and watersheds in the plan area, including components to maintain or restore structure, function, composition, and connectivity, taking into account opportunities for landscape scale restoration." All proposed modifications to the Forest Plan, under this amendment, would allow the project to be implemented in a manner to support landscape-scale forest restoration within the 140,000-acre project area. The methods for implementing the project all consider the ecological integrity for terrestrial and aquatic ecosystems and watersheds during design, construction, and maintenance; benefitting not only ecological sustainability but also providing long-term benefits for social and economic sustainability for the area's future.

The Forest Plan amendment to authorize the management of unplanned wildfires for multiple resource objectives across portions of the project area where this management is not currently authorized, would result in long-term reduction in large-scale, uncharacteristic wildfire risk. By authorizing the management of unplanned wildfire, fewer damaging suppression techniques would need to be applied to areas where fire can safely burn without threatening life and property. Subsequent beneficial impacts to vegetation community resources, soils, watersheds, water quality, and fire and fuels would be achieved by allowing the reintroduction of fire into larger areas of fire-dependent vegetation. The reintroduction of fire would help to bring vegetation communities back to within a range of natural variability, and help to restore historic fire regimes. This modification of the Forest Plan would also result in beneficial impacts to soil and watershed resources because the forest health conditions would improve, thereby improving watershed functions. Improved watershed functions would be expected to also improve water quality and riparian areas within the South Sacramento Restoration Project area.

Forest restoration activities, including vegetation thinning and the use of prescribed fire, within protected activity centers would result in beneficial impacts to air quality, soils, watersheds, and native vegetative communities because the potential for fuel removal in these areas would be greatly restricted without the amendment. Forest restoration activities within Mexican spotted owl protected activity centers would improve forest health and resilience in a larger portion of the project area over the long term, thereby resulting in decrease in uncharacteristic wildfire potential and reduced risk of insect and disease.

The modification to the Forest Plan to allow the use of pesticides to meet oak and juniper resprout control objectives would result in long-term beneficial impacts to native vegetation communities because the targeted use of pesticides would help maintain the open forest structure achieved by initial thinning activities for a longer time period compared to not using targeted pesticides. The oak and juniper resprouts can be vigorous and reduce the effectiveness of forest restoration treatments within a few years if not controlled. Chemical treatment of oak and juniper resprouts in municipal watersheds or near areas of human habitation would be localized. Application would follow label requirements including the application rate, conditions, and formulations appropriate to meet treatment goals while minimizing drift and potential contamination of water sources. Additionally, only targeted application is proposed to minimize potential soil and water contamination.

Allowing treatments to occur on steeper slopes would reduce fuel continuity and reduce stand densities, thereby mitigating crown fire potential and the risk of high-intensity, stand-replacing wildfire. Long-term beneficial impacts to vegetation communities, air quality, soils, and watersheds would result because severe wildfires that are uncharacteristic in a number of the ecological response units in the project area would be mitigated. Furthermore, forest restoration activities on steep slopes would improve the vigor of residual trees by reducing competition for scarce resources, increasing the resilience of stands to insect and disease risk in a larger portion of the project area, and thereby resulting in improved forest health and watershed functioning. Improved watershed functions would be expected to also improve water quality and riparian areas within the South Sacramento Restoration Project area.

Furthermore, by allowing mechanized equipment to be used on slopes greater than 40 percent, a larger portion of the project area would be open to the removal of forest products. Increased revenue to the Federal Government and increased income to contractors would be expected as a result of this proposed Forest Plan amendment, thereby supporting the plan area's contribution to social and economic sustainability.

The proposed modification to the Forest Plan to allow for mechanical treatments on steep slopes could alter recreation experience, particularly scenery as a result of surface disturbance, smoke and charred vegetation from unplanned and prescribed fires, and long-term changes in vegetation structure and composition. The impacts to scenery and recreational settings would be localized and visible in both the short and long term. Impacts from smoke would be short term; these impacts would dissipate when fire activities cease. Resulting charred vegetation from fires would be visible in the long term. Scenic quality would be further impacted by the presence of activity slash and temporary roads and skid trails in the short term. These impacts would be reduced by natural vegetation regeneration and site rehabilitation in the long term. Changes to vegetation structure would have long-term, positive effects on scenic quality because improving forest health and resiliency also improves the recreation setting.

The proposed modifications to the Forest Plan would result in improved forest health, which would also improve ecosystem services and provide multiple use opportunities to local communities, such as clean air and water, an improved recreational setting, and increased forage for wildlife and livestock. By ensuring resilient ecosystems, the Forest Service can help to sustain local economic and social well-being, promote a sustainable flow of societal benefits, and manage multiple uses over the long term, so that these lands provide enduring ecosystem services and contribute to social and economic stability, as well. The proposed action would allow for beneficial economic impacts such as jobs, federal spending, timber revenues, and income to be recognized by the local communities within Otero County.

In conclusion, the proposed modifications to the Forest Plan would not result in substantial adverse effects associated with the sustainability requirement nor would the proposed amendment substantially lessen protection for a specific resource or use associated with social, economic, or ecological sustainability. As a result, this plan amendment is consistent with the sustainability requirements at 36 CFR 219.8.

36 CFR 219.9 Diversity of Plant and Animal Communities

Per 36 CFR 219.9, "a plan developed or revised under this part must provide for the diversity of plant and animal communities, within Forest Service authority and consistent with the inherent capability of the plan area…". Additionally, the plan must support the persistence of most native species in the plan area. Specifically, the activities that would be authorized by the amendment could potentially influence protections for:

a) ecosystem plan components including ecosystem integrity of terrestrial and aquatic ecosystems and watersheds; and

b) species-specific plan components including providing for ecological conditions that contribute to the recovery of federally listed, proposed, and candidate species, and that contribute to the viability of species of conservation concern.

The project analysis includes consideration of substantial adverse impacts to or substantially lessens protections for federally listed, sensitive, management indicator, and other plant and animal species that may occur as a result of the amendment in accordance with 36 CFR 219.13(b)(6).

The Lincoln National Forest analyzed impacts to plant and animal communities through two specialist reports: a wildlife biological evaluation and botany biological evaluation. In addition to these reports, a biological assessment was completed to support Endangered Species Act Section 7 consultation with the U.S. Fish and Wildlife Service regarding potential effects on three federally listed species: the Mexican spotted owl (*Strix occidentalis lucida*), the Peñasco least chipmunk (*Tamias minimus atristriatus*), and the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*). The analysis below is informed by these three reports.

Stand-replacing fire has been defined as a major threat to the Mexican spotted owl and its critical habitat. The proposed modifications to the Forest Plan allowing for forest restoration activities, including vegetation thinning and the use of prescribed fire, within protected activity centers and critical habitat would improve ecological conditions for the species. Following treatments planned in the South Sacramento Restoration Project proposed action, crown fire hazard would decrease through fuel load reduction treatments. Furthermore, the proposed modifications to the Forest Plan would help the project area trend toward having a more diverse stand structure to meet the desired conditions for Mexican spotted owl, as defined in the 2012 recovery plan; thereby making the species' habitat more resilient to future wildfires as well as insect and disease infestations. The proposed forest restoration treatments are intended to shift the mixed conifer ecological response units toward trending to meet conditions more desirable for the persistence Mexican spotted owl habitat as well as more resilient toward wildfire.

Currently, there is an overall lack of suitable habitat for the Peñasco least chipmunk in the Sacramento Mountains. The proposed modifications to the Forest Plan, including forest restoration treatments in ponderosa pine habitat, coupled with potential reintroduction of the species in areas of suitable habitat in the Sacramento Mountains, could increase the possibility of species survival within its historic range.

The proposed action, which includes the proposed modifications to the Forest Plan, focuses on restoration activities in upland areas while resource protection measures were designed to minimize or avoid activities that would result in negative impacts to the New Mexico meadow jumping mouse individuals and habitat. The hydrologic function of the landscapes should be enhanced by the restoration treatments within the South Sacramento Restoration Project area.

For migratory birds, the activities associated with the proposed modifications to the Forest Plan, such as allowing for mechanized treatment on slopes greater than 40 percent, treatment within protected activity centers and northern goshawk habitat, and treatments within other essential habitat for federally listed species, would result in short-term negative impacts as well as long-term beneficial impacts to migratory birds. In the short-term these proposed modifications to the Forest Plan would allow for restoration treatment that may disturb nests and disrupt courtship of nesting pairs. However, the proposed modifications to the Forest Plan are expected to provide better habitat for migratory birds by creating openings and enhancing the development of large trees.

The analysis provided above for the three federally listed species and migratory birds provides a good representation of how the proposed modifications to the Forest Plan would contribute to ecosystem integrity of terrestrial ecosystems and watersheds within the South Sacramento Restoration Project area. The proposed modifications to the Forest Plan would result in long-term beneficial conditions for animal communities.

Similarly, for plant communities, the proposed modifications to the Forest Plan would allow for forest restoration treatment that would result in long-term beneficial conditions for plant species because forest restoration activities would improve watershed health, potentially the hydrologic function of springs and wetlands, and plant species habitat within and adjacent to treatment areas.

In conclusion, the proposed modifications to the Forest Plan would not result in substantial adverse impacts to plant and animal communities within the South Sacramento Restoration Project area, including those species of conservation concern. Nor would the proposed amendment substantially lessen protection for any plant and animal species. The proposed modifications to the Forest Plan support the persistence of native species in the South Sacramento Restoration Project area. As a result, this plan amendment is consistent with the diversity of plant and animal communities as required by 36 CFR 219.9.

36 CFR 219.10 Multiple Use

Per 36 CFR 219.10, “a plan developed or revised under this part must provide for ecosystem services and multiple uses, including outdoor recreation, range, timber, watershed, wildlife, and fish, within Forest Service authority and the inherent capability of the plan area…”. Specifically, the activities that would be authorized by the amendment could potentially influence provisions for integrated resource management for multiple use including:

a) aesthetic values, air quality, cultural and heritage resources, ecosystem services, fish and wildlife species, forage, grazing and rangelands, habitat and habitat connectivity, recreation settings and opportunities, riparian areas, scenery, soil, surface and subsurface water quality, timber, trails, vegetation, viewsheds, and other relevant resources and uses;

b) protections for public water supplies and water quality; and

c) scenic character.

The discussion of the proposed amendment's ability to support and enhance watershed conditions and wildlife habitat within the South Sacramento Restoration Project area is provided under 36 CFR 219.8 Sustainability and 36 CFR 219.9 Diversity of Plant and Animal Communities. Watershed conditions, wildlife habitat, and timber are all resources as well as multiple uses that would be improved by the proposed modifications to the Forest Plan. Beneficial impacts to these resources would also improve the associated multiple uses. For example, by improving the watershed conditions and wildlife habitat, there would be increased opportunities for wildlife viewing, improved recreational uses, and sustainable ecosystems. Timber treatments allowed as part of the proposed modifications to the Forest Plan could also contribute to traditional cultural uses, forest product industries, rangeland uses because access to such forest products or opening up stands would be desirable.

Under the current Forest Plan, most of the restoration treatments would not be consistent with current retention and partial retention visual quality objectives in the short term, over the duration of the project. However, as part of the proposed action, the Forest Plan would be modified to exempt the South Sacramento Restoration Project area from meeting retention and partial-retention visual quality objectives until slash disposal treatments and rehabilitation of landings, skid trails, and temporary roads are completed. The proposed amendment would allow for individual forest restoration treatments to be implemented over a longer duration, allowing the area to meet visual quality objectives. Certain project activities, such as landings and skid trails, would have short-term adverse impacts to visual resources in portions of the project area where treatments may take longer to implement and restoration activities would be visible to the public, such as recreation users. This modification would have major beneficial impacts in the long term for visual resources as the project's desired conditions, increased diversity of age-class, species, and spatial distribution in the forests; increased diversity of sizes of tree groups and openings between groups of trees; increased areas of open canopy cover to reestablish scenic views; and restored and maintained waterways and meadows, would not only enhance the landscape character, but would also provide improvements for a variety of other uses as required by 36 CFR 219.10.

Similarly, the proposed modification to the Forest Plan to allow for mechanical treatments on steep slopes could alter recreation experience, particularly scenery as a result of surface disturbance, smoke and charred vegetation from unplanned and prescribed fires, and long-term changes in vegetation structure and composition. The impacts to scenery and recreational settings would be localized and visible in both the short and long term. Impacts from smoke would be short term; these impacts would dissipate when fire activities cease. Resulting charred vegetation from fires would be visible in the long term. Scenic quality would be further impacted by the presence of activity slash and temporary roads and skid trails in the short term. These impacts would be reduced by natural vegetation regeneration and site rehabilitation in the long term. Changes to vegetation structure would have long-term, positive effects on scenic quality because improving forest health and resiliency also improves the recreation setting. Chemical treatment of oak and juniper resprouts in municipal watersheds or near areas of human habitation would be localized. Application would follow label requirements including the application rate, conditions, and formulations appropriate to meet treatment goals while minimizing drift and potential contamination of water sources. Additionally, only targeted application is proposed to minimize potential soil and water contamination. The modification to the Forest Plan to allow the use of pesticides to meet oak and juniper resprout control objectives would not result in substantial impacts to public water sources.

In conclusion, the proposed modifications to the Forest Plan would not result in substantial adverse effects associated with the multiple use requirement nor would the proposed amendment substantially lessen protection for a specific resource, such as cultural resources, or use associated with multiple use. As a result, this plan amendment is consistent with the multiple use requirements at 36 CFR 219.10.

Project and Activity Consistent with Plan

In conclusion, no conflicts or inconsistencies with the 2012 Planning Rule substantive requirements have been identified for the proposed amendment listed above. The proposed amendment would aid forest restoration efforts by allowing implementation of needed vegetation treatments across the South Sacramento Restoration Project area, as opposed to treating smaller portions of the project area. While there would be short-term adverse impacts from the project, the resulting long-term benefits would be a sustainable, resilient forest ecosystem capable of supporting diverse plant and animal communities and multiple uses valued by local communities and visitors.

APPENDIX B – NONNATIVE INVASIVE PLAN SPECIES LIST

Table B.1. Nonnative Invasive Plant Species that May Occur on the Lincoln National Forest

Common Name	Scientific Name
African rue	*Peganum harmala*
alfombrilla	*Drymaria arenarioides*
black henbane	*Hyoscyamus niger*
bull thistle	*Cirsium vulgare*
camelthorn	*Alhagi pseudalhagi*
Canada thistle	*Cirsium arvense*
cheatgrass	*Bromus tectorum*
common burdock	*Arctium minus*
common mullein	*Verbascum thapsus*
Dalmatian toadflax	*Linaria dalmatica*
dandelion	*Taraxacum officinale*
diffuse knapweed	*Centaurea diffusa*
dyer's woad	*Isatis tinctoria*
Eurasian watermilfoil	*Myriophyllum spicatum*
field bindweed	*Convolvulus arvensis*
hoary cress	*Cardaria* spp.
houndstongue	*Cynoglossum officinale*
hydrilla	*Hydrilla verticillata*
jointed goatgrass	*Aegilops cylindrica*
leafy spurge	*Euphorbia esula*
Malta starthistle	*Centaurea melitensis*
musk thistle	*Carduus nutans*
onionweed	*Asphodelus fistulosus*
perennial pepperweed	*Lepidium latifolium*
purple loosestrife	*Lythrum salicaria*
purple starthistle	*Centaurea calcitrapa*
poison hemlock	*Conium maculatum*
Russian knapweed	*Acroptilon repens*
Scotch thistle	*Onopordum acanthium*
Siberian elm	*Ulmus pumila*
spiny cocklebur	*Xanthium spinosum*
spotted knapweed	*Centaurea maculosa*
tamarisk/saltcedar	*Tamarix* spp.
teasel	*Dipsacus fullonum*
watercress	*Nasturtium officinale*
yellow bluestem and King Ranch bluestem	*Bothriochloa ischaemum* var. *ischaemum* and *Bothriochloa ischaemum* var. *songarica*
yellow starthistle	*Centaurea solstitialis*
yellow toadflax	*Linaria vulgaris*

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APPENDIX C – WILDLIFE SPECIES, ADDITIONAL INFORMATION

The U.S. Fish and Wildlife Service Information for Planning and Consultation online interactive database lists federally threatened or endangered species, candidate species, and one experimental (non-essential species) population within Otero County (U.S. Fish and Wildlife Service 2017). These species are represented in the enclosed letter.

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United States Department of the Interior

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In Reply Refer To: November 06, 2017
Consultation Code: 02ENNM00-2018-SLI-0115
Event Code: 02ENNM00-2018-E-00255
Project Name: South Sacramento Restoration EIS

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

Thank you for your recent request for information on federally listed species and important wildlife habitats that may occur in your project area. The U.S. Fish and Wildlife Service (Service) has responsibility for certain species of New Mexico wildlife under the Endangered Species Act (ESA) of 1973 as amended (16 USC 1531 et seq.), the Migratory Bird Treaty Act (MBTA) as amended (16 USC 701-715), and the Bald and Golden Eagle Protection Act (BGEPA) as amended (16 USC 668-668c). We are providing the following guidance to assist you in determining which federally imperiled species may or may not occur within your project area and to recommend some conservation measures that can be included in your project design.

FEDERALLY-LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

Attached is a list of endangered, threatened, and proposed species that may occur in your project area. Your project area may not necessarily include all or any of these species. Under the ESA, it is the responsibility of the Federal action agency or its designated representative to determine if a proposed action "may affect" endangered, threatened, or proposed species, or designated critical habitat, and if so, to consult with the Service further. Similarly, it is the responsibility of the Federal action agency or project proponent, not the Service, to make "no effect" determinations. If you determine that your proposed action will have "no effect" on threatened or endangered species or their respective critical habitat, you do not need to seek concurrence with the Service. Nevertheless, it is a violation of Federal law to harm or harass any federally-listed threatened or endangered fish or wildlife species without the appropriate permit.

If you determine that your proposed action may affect federally-listed species, consultation with the Service will be necessary. Through the consultation process, we will analyze information contained in a biological assessment that you provide. If your proposed action is associated with

Federal funding or permitting, consultation will occur with the Federal agency under section 7(a)(2) of the ESA. Otherwise, an incidental take permit pursuant to section 10(a)(1)(B) of the ESA (also known as a habitat conservation plan) is necessary to harm or harass federally listed threatened or endangered fish or wildlife species. In either case, there is no mechanism for authorizing incidental take "after-the-fact." For more information regarding formal consultation and HCPs, please see the Service's Consultation Handbook and Habitat Conservation Plans at www.fws.gov/endangered/esa-library/index.html#consultations.

The scope of federally listed species compliance not only includes direct effects, but also any interrelated or interdependent project activities (e.g., equipment staging areas, offsite borrow material areas, or utility relocations) and any indirect or cumulative effects that may occur in the action area. The action area includes all areas to be affected, not merely the immediate area involved in the action. Large projects may have effects outside the immediate area to species not listed here that should be addressed. If your action area has suitable habitat for any of the attached species, we recommend that species-specific surveys be conducted during the flowering season for plants and at the appropriate time for wildlife to evaluate any possible project-related impacts.

Candidate Species and Other Sensitive Species

A list of candidate and other sensitive species in your area is also attached. Candidate species and other sensitive species are species that have no legal protection under the ESA, although we recommend that candidate and other sensitive species be included in your surveys and considered for planning purposes. The Service monitors the status of these species. If significant declines occur, these species could potentially be listed. Therefore, actions that may contribute to their decline should be avoided.

Lists of sensitive species including State-listed endangered and threatened species are compiled by New Mexico state agencies. These lists, along with species information, can be found at the following websites:

Biota Information System of New Mexico (BISON-M): www.bison-m.org

New Mexico State Forestry. The New Mexico Endangered Plant Program: www.emnrd.state.nm.us/SFD/ForestMgt/Endangered.html

New Mexico Rare Plant Technical Council, New Mexico Rare Plants: nmrareplants.unm.edu

Natural Heritage New Mexico, online species database: nhnm.unm.edu

WETLANDS AND FLOODPLAINS

Under Executive Orders 11988 and 11990, Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and floodplains, and preserve and enhance their natural and beneficial values. These habitats should be conserved through avoidance, or mitigated to ensure that there would be no net loss of wetlands function and value.

We encourage you to use the National Wetland Inventory (NWI) maps in conjunction with ground-truthing to identify wetlands occurring in your project area. The Service's NWI program website, www.fws.gov/wetlands/Data/Mapper.html integrates digital map data with other resource information. We also recommend you contact the U.S. Army Corps of Engineers for permitting requirements under section 404 of the Clean Water Act if your proposed action could impact floodplains or wetlands.

MIGRATORY BIRDS

The MBTA prohibits the taking of migratory birds, nests, and eggs, except as permitted by the Service's Migratory Bird Office. To minimize the likelihood of adverse impacts to migratory birds, we recommend construction activities occur outside the general bird nesting season from March through August, or that areas proposed for construction during the nesting season be surveyed, and when occupied, avoided until the young have fledged.

We recommend review of Birds of Conservation Concern at website www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BCC.html to fully evaluate the effects to the birds at your site. This list identifies birds that are potentially threatened by disturbance and construction.

BALD AND GOLDEN EAGLES

The bald eagle (Haliaeetus leucocephalus) was delisted under the ESA on August 9, 2007. Both the bald eagle and golden eagle (Aquila chrysaetos) are still protected under the MBTA and BGEPA. The BGEPA affords both eagles protection in addition to that provided by the MBTA, in particular, by making it unlawful to "disturb" eagles. Under the BGEPA, the Service may issue limited permits to incidentally "take" eagles (e.g., injury, interfering with normal breeding, feeding, or sheltering behavior nest abandonment). For information on bald and golden eagle management guidelines, we recommend you review information provided at www.fws.gov/midwest/eagle/guidelines/bgepa.html.

On our web site www.fws.gov/southwest/es/NewMexico/SBC_intro.cfm, we have included conservation measures that can minimize impacts to federally listed and other sensitive species. These include measures for communication towers, power line safety for raptors, road and highway improvements, spring developments and livestock watering facilities, wastewater facilities, and trenching operations.

We also suggest you contact the New Mexico Department of Game and Fish, and the New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division for information regarding State fish, wildlife, and plants.

Thank you for your concern for endangered and threatened species and New Mexico's wildlife habitats. We appreciate your efforts to identify and avoid impacts to listed and sensitive species in your project area. For further consultation on your proposed activity, please call 505-346-2525 or email nmesfo@fws.gov and reference your Service Consultation Tracking Number.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New Mexico Ecological Services Field Office
2105 Osuna Road Ne
Albuquerque, NM 87113-1001
(505) 346-2525

Project Summary

Consultation Code: 02ENNM00-2018-SLI-0115

Event Code: 02ENNM00-2018-E-00255

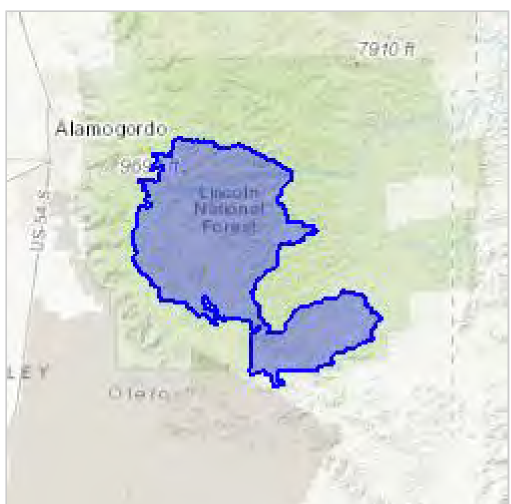
Project Name: South Sacramento Restoration EIS

Project Type: LAND - RESTORATION / ENHANCEMENT

Project Description: The U.S. Forest Service, Lincoln National Forest, in cooperation with the U.S. Fish and Wildlife Service and the New Mexico Department of Game and Fish, is developing the South Sacramento Restoration Project that would address forest health issues, hazardous fuels, and declining wildlife habitat quality on the Sacramento Ranger District at a landscape scale. The purpose of this project is to restore overall forest health, watershed health, and wildlife habitat for each ecological response unit in the project area. There is a need to increase forest resiliency to insects, disease, and climate change by shifting forest structure, composition, and diversity toward desired conditions within the historic (or natural) range of variability for each forest type.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/32.74284298579944N105.72837530368778W



Counties: Otero, NM

Endangered Species Act Species

There is a total of 11 threatened, endangered, or candidate species on this species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

Mammals

NAME	STATUS
New Mexico Meadow Jumping Mouse *Zapus hudsonius luteus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7965	Endangered
Penasco Least Chipmunk *Tamias minimus atristriatus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5126	Candidate

Birds

NAME	STATUS
Least Tern *Sterna antillarum* Population: interior pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8505	Endangered
Mexican Spotted Owl *Strix occidentalis lucida* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8196	Threatened
Northern Aplomado Falcon *Falco femoralis septentrionalis* Population: U.S.A (AZ, NM) No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1923	Experimental Population, Non-Essential
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **proposed** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Flowering Plants

NAME	STATUS
Kuenzler Hedgehog Cactus *Echinocereus fendleri var. kuenzleri* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2859	Endangered
Sacramento Mountains Thistle *Cirsium vinaceum* There is **proposed** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/7486	Threatened
Sacramento Prickly Poppy *Argemone pleiacantha ssp. pinnatisecta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3332	Endangered
Todsen's Pennyroyal *Hedeoma todsenii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1081	Endangered
Wright's Marsh Thistle *Cirsium wrightii* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8963	Candidate

Critical habitats

There are 2 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Mexican Spotted Owl *Strix occidentalis lucida* https://ecos.fws.gov/ecp/species/8196#crithab	Final
New Mexico Meadow Jumping Mouse *Zapus hudsonius luteus* https://ecos.fws.gov/ecp/species/7965#crithab	Final

Species listed in Table C-1 are not expected to occur near or within the project area, due to the range of the species or lack of habitat, and are assumed to be unaffected by the proposed action. Therefore, these species would not be carried forward in the analysis.

Table C-1. Species Protected by the Endangered Species Act that are Excluded from Detailed Analysis

Scientific Name	Common Name	Status
Hedeoma todsenii	Todsen’s pennyroyal	Endangered
Coccyzus americanus	Yellow-billed cuckoo	Threatened
Cirsium wrightii	Wright’s marsh thistle	Candidate
Falco femoralis septentrionalis	Northern aplomado falcon	Experimental Population, Non-Essential
Sterna antillarum	Least tern (Interior Population)	Endangered

Table C-2 and C-3 show all Management Indicator Species and Regional Forester Sensitive Species that were considered for analysis in this environmental impact statement. These tables provide rationale for the species either carried forward for detailed analysis or dismissed from detailed analysis.

Table C-2. Management Indicator Species on the Lincoln National Forest

Common Name (Scientific Name)	Ecosystem Represented	Key Habitat Factor	Selection Justification
Elk (*Cervus canadensis*)	Mixed conifer	Open mixed conifer and mountain meadows	Will be addressed in detail because the key habitat factors for this species are found within the project area. This species is also an important game “game” species.
Mule deer (*Odocoileus hemionus*)	Woodlands	Shrub cover and browse species	Will be addressed in detail because the key habitat factors for this species are found within the project area. This species is also an important game species.
Meadowlark (*Sturnella neglecta*)	Grama Galleta Grassland	Open weedy grasslands with little to no shrub or tree cover	Will not be carried forward in the analysis as the key habitat factors for this species are not found within the project area.
Red squirrel (*Tamiasciurus hudsonicus*)	Mixed conifer	Mixed conifer forests in closed canopies with large, cone-bearing trees	Will be addressed in detail because the key habitat factors for this species are found within the project area.
Mexican vole (*Microtus mexicanus*)	Mixed conifer	High-elevation steep slope mesic meadows associated with seeps and springs	Will be addressed in detail because the key habitat factors for this species are found within the project area.
Juniper titmouse (*Baeolophus ridgwayi*)	Woodland	Trees with naturally occurring cavities	Will be addressed in detail because the key habitat factors for this species are found within the project area.
Pygmy nuthatch (*Sitta pygmaea*)	Ponderosa pine	Snags and large trees	Will be addressed in detail because the key habitat factors for this species are found within the project area.
Rufous-crowned sparrow (*Aimophila ruficeps*)	Desert shrub	Brushy mountain slopes	Will be addressed in detail because the key habitat factors for this species are found within the project area.
Hairy woodpecker (*Picoides villosus*)	Mixed Conifer	Aspen stands within mixed conifer forests	Will be addressed in detail because the key habitat factors for this species are found within the project area.

Table C-3. Regional Forester’s Sensitive Species on the Lincoln National Forest

Common Name	Scientific Name	Districts	Habitat	Status in Project Area	Species Carried Forward for Analysis
Sacramento Mountains salamander	*Aneides hardii*	D1, D2	Ponderosa Pine, Mixed Conifer, Aspen slopes above 7500 feet elevation	Species has habitat and does occur in the project area	Yes
Northern goshawk	*Accipiter gentilis*	D1, D2	Ponderosa pine and mixed conifer forests	Species and habitat occur in the proposed project area	Yes
Baird's sparrow	*Ammodramus bairdii*	D2 (near)	Open grasslands, pinyon-juniper savannah. Greater than 5 miles away from Lincoln National Forest boundary on the east side of the Sacramento Ranger District.	Species occurs near the district but does not have habitat or occur within the proposed project area	No
Burrowing owl (western)	*Athene cunicularia hypugaea*	D1 (near)	Open grasslands and pinon-juniper savannahs. Associated with prairie dog colonies. Within 1 mile of Lincoln National Forest boundary near the Capitan Mountains.	Species does not occur or have habitat on the district. Species does not have habitat or occur within the proposed project area	No
American peregrine falcon	*Falco peregrinus anatum*	D1, D2, D3	Steep cliffs and canyons. Known in Fresnal Canyon area, Three Rivers, Carizo Peak, Pancho Canyon, Dog Canyon, Big Canyon, McKittrick Canyon.	Species does occur on the district. Species does not occur and does not have habitat within the proposed project area.	No
Bald eagle	*Haliaeetus leucocephalus*	D1, D2, D3	Wetlands, stream habitat. Prefers large open bodies of water. In migration, can be found by any size wetland or water.	Species does occur on the district. Species may forage and may use foraging habitat within the proposed project area.	Yes
Varied bunting	*Passerina versicolor*	D3 (near)	Thorn brush at riparian edges, arid scrublands, scrubby woodland, and overgrown clearings, desert scrub. Nearest occurrence seen Carlsbad National Park.	Species does not occur or have habitat on the district. Species does occur or have habitat within the proposed project area	No
Arizona Bell's vireo	*Vireo bellii arizonae*	D2, D3 (near)	Open grasslands and pinyon-juniper savannah, often associated with intermittent streams. Greater than 5 miles away from Lincoln National Forest boundary on the southeast side of the Guadalupe Mountains, and greater than 5 miles away from the eastern border of the Lincoln National Forest on the Sacramento Ranger District.	Species does occur near the district. Species does not have habitat or occur within the proposed project area.	No
Gray vireo	*Vireo vicinior*	D2, D3	Pinyon-juniper habitat below 7,000 feet elevation	Species does occur on the district. Species is likely to occur or have suitable habitat within the proposed project area.	Yes

Common Name	Scientific Name	Districts	Habitat	Status in Project Area	Species Carried Forward for Analysis
Fairy shrimp	*Streptocephalus n. sp.1*	D1	Permanent to intermittent isolated ponded wetlands at elevations about 6,000 feet and above	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Greenthroat darter	*Etheostoma lepidum*	D1	Swift-flowing springs, headwaters, creeks, and small rivers, especially vegetated riffle areas with gravel and rubble substrates	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Rio Grande chub	*Gila pandora*	D2, D3	Cold clear water with vegetational the edges, especially aquatic vegetation or overhanging trees for shading.	Species does occur on the district. Species does not occur or have suitable habitat within the proposed project area.	No
Headwater catfish	*Ictalurus lupus*	D3	Sandy and rocky riffles, runs, and pools of clear creeks and small rivers; springs; clear temperate waters generally with a moderate gradient. Sitting Bull Falls and other permanent waters in the Guadalupes.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Rio Grande cutthroat trout	*Oncorhynchus clarki virginalis*	D1	Clear and cold (higher elevation) fast-flowing waters with high oxygen content. Reintroduced population at Pine Lodge Creek.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Sacramento Mountains checkerspot butterfly	*Euphydryas anicia cloudcrofti*	D2	High-elevation wetland riparian areas and wet meadows.	Species does occur on the district. Species not known to occur but may have suitable habitat within the proposed project area.	Yes
A caddisfly	*Psychoronia brooksi*	D1	Found in North Fork Rio Ruidoso, near entrance to Ski Apache. Flowing water and seepage spring habitats. Found throughout the North Fork of the Rio Ruidoso.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Bonita diving beetle	*Stictotarusus neomexicana* (aka. *Deroneotes n.*)	D1	Permanent to intermittent ponded wetlands or high-elevation pools.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	D1, D2, D3	Forage in a variety of habitats, from pine forests to arid desert scrub, almost always near caves or mines. Roost in open cave rooms or mines.	Species does occur on the district. Species does occur and has habitat within the proposed project area.	Yes
Spotted bat	*Euderma maculatum*	D1, D2	Forage in arid or ponderosa pine forests, and marshlands, and large open habitat. Roost in the small cracks found in cliffs and stony outcrops.	Species does occur on the district. Species does occur and has habitat within the proposed project area.	Yes
Western red bat	*Lasiurus blossevillii*	D1, D2, D3	Prefer riparian habitat, roosting in trees. Cottonwoods, sycamore, oaks, walnuts.	Species does occur on the district. Species does occur and has habitat within the proposed project area.	Yes

Common Name	Scientific Name	Districts	Habitat	Status in Project Area	Species Carried Forward for Analysis
Peñasco least chipmunk	*Neotamias minimus atristriatus*	D1, D2	High-elevation alpine and sub-alpine open meadows, talus slopes, open montane grassy areas.	Species and habitat historically occurred on the district and possibly within the project area.	This species is a federal candidate species and has been proposed for federal listing, and will be addressed with the federally listed species and the biological assessment.
New Mexico shrew	*Sorex neomexicanus*	D1, D2	Capitan and Sacramento Mountains. Meadows and in leaf litter in canyons of coniferous forests, often along streams. Mesic conifer-aspen forest in sheltered canyons.	This species does occur on the district. This species may occur and there is suitable habitat within the proposed project area.	Yes
Guadalupe pocket gopher	*Thomomys bottae guadalupensis*	D3	Sycamore, cottonwood, and rabbitbrush riparian habitats. Loose soils, open grassy pine bottoms. In the Guadalupe Mountains it can be restricted largely to the poorer, thinner soils on the dry, rocky flats and the lower slopes of the mountains and may be absent from the deeper soils at the bases of the mountains, which are occupied by Pappogeomys. McKittrick Canyon.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Arid land ribbonsnake	*Thamnophis proximus diabolicus*	D3	Semi-aquatic species. Streams, ponds, marshes, stock tanks. Riparian and emergent vegetation, including willows, cattails, and bulrushes. Foraging in wetland and water.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Mottled rock rattlesnake	*Crotalus lepidus lepidus*	D3	Sky island mountain ranges, from 4,000 to 8,000 feet elevation. Large rock outcroppings, canyon walls, rock overhangs, rocky stream beds, talus slopes. Rocky canyons or hillsides, cave openings, rock houses.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Capitan woodlandsnail	*Ashmunella pseudodonta*	D1	Terrestrial. Talus slopes or rock glaciers. East end of Capitan, talus slope about 6,200 feet elevation. Ranges lower and higher in elevation. Lone and Carrizo Peaks, Patos Mountains, White Oaks, and near Baldonado Springs.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No

Common Name	Scientific Name	Districts	Habitat	Status in Project Area	Species Carried Forward for Analysis
Rio Grande snaggletooth	*Gastrocopta riograndensis*	D2	Sacramento Canyon Falls, Sacramento Ranger District, thin soil accumulations on small ledges of xeric south-facing limestone cliffs in the Sacramento Mountains, where organic litter is generated from grasses and shrubs.	Species does occur on the district. Species does not occur or have habitat within the proposed project area.	No
Ruidoso snaggletooth	*Gastrocopta ruidosensis*	D1, D2	Found on bare soil, under stones, and in thin accumulations of grass thatch and juniper litter on mid-elevation carbonate cliffs and xeric limestone grasslands along the eastern slopes, Sacramento Mountain range.	Species does occur on the district. Species may occur or have habitat within the proposed project area	Yes
Vagabond holospira	*Holospira montivaga*	D3	Fairly exposed, arid western slopes of the Guadalupe Mountains. Cliff sides of wooded canyons. Rocky ledges of cliffs, canyon walls and outcrops at 7,000 feet elevation in ponderosa/ Gambel oak/pinyon/live oak. Black Canyon and southwestern edge of the Guadalupe Mountains.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
Northern threeband	*Humboltiana ultima*	D3	In or around seeps and springs of deep canyons, at the base of steep cliffs, often under deciduous trees with moist soils and leaf litter. Also in rock rubble and leaf litter, but not talus slopes.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No
No common name	*Oreohelix nogalensis* (aka *O. strigosa nogalensis*)	D1	Sierra Blanca and Nogal Peak mountain complex. Canyon habitat above 7,000 feet elevation. Steep leafy slopes with very little rock, above the canyon bed. Overstory maples, aspen. On Nogal Peak, pine-oak woodlands in mesic areas.	Species does not occur on the district. Species does not occur or have habitat within the proposed project area.	No

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