Biological Assessment for the Revision of the Santa Fe National Forest Land and Resource Management Plan

Rio Arriba, San Miguel, Sandoval, Santa Fe, Mora, and Los Alamos Counties, New Mexico

Mexican Spotted Owl: Photo by Amber Bishop, Wildlife Biologist, Santa Fe National Forest, USDA

Prepared by: Nancy Kelly, Wildlife Biologist Enterprise Program
Date: August 6, 2020

Reviewed by: Daryl Ratajczak
Date: August 24, 2020

Approved By:

Executive Summary

This biological assessment analyzes the programmatic effects of long-term management of the Santa Fe National Forest. Analysis is tiered to the 2012 planning regulations (36 CFR Part 219, Subpart B, 2012). Following the conclusion of the pre-decisional administrative review process, if any substantive changes to the alternatives or forest plan are made, consultation will be re-initiated as appropriate. The Record of Decision will be issued following receipt of the final Biological Opinion for the revised forest plan.

This biological assessment considers the potential effects of the proposed action on the federally threatened Mexican Spotted Owl, and three federally endangered species; the Jemez Mountains Salamander, the New Mexico Meadow Jumping Mouse, and the plant Holy Ghost ipomopsis (USFWS 2019a). At present there are no known federal candidate or federal proposed species on the forest. Three endangered species, the Southwestern Willow Flycatcher, Least Tern and Rio Grande Silvery Minnow are outside the forest boundary, but are within watersheds shared by the Santa Fe NF and surrounding lands. None of these species occur in the plan area. A threatened species, the Western Yellow-Billed Cuckoo could potentially use limited riparian habitat on the Santa Fe NF, but is only known as a migrant and has not been documented on the forest. Canada Lynx, threatened in NM, has not been documented to den or breed on the Santa Fe NF.

Table 1. Federally listed threatened and endangered species and designated critical habitats addressed in this biological assessment. Species indicated with a * are carried forward for analysis in this document.

Scientific Name	Common Name	Federal Status	Species determination	Critical Habitat (CH)	Critical Habitat determination
Mammals					
Lynx canadensis	Canada lynx	Threatened	Not present on the forest. No Effect. (See description below).	No CH in analysis area.	No Effect
*Zapus hudsonius luteus**	New Mexico meadow jumping mouse	Endangered	May affect, likely to adversely affect.	CH in analysis area.	May affect, likely to adversely affect.
Birds					
Coccyzus americanus occidentalis	Western yellow-billed cuckoo	Threatened w of Rio Grande, Distinct Population Segment (DPS)	Not present on the forest. No Effect. (See description below).	No CH in analysis area.	No Effect
Empidonax traillii extimus	Southwestern willow flycatcher	Endangered	Not present on the forest. No Effect. (See description below).	No CH in analysis area.	No Effect
*Strix occidentalis lucida**	Mexican spotted owl	Threatened	May affect, likely to adversely affect	CH in analysis area.	May affect, likely to adversely affect.
Sterna antillarum	Least tern	Endangered	Not present on the forest. No Effect. (See description below).	No CH in analysis area.	No Effect
Fish					

Scientific Name	Common Name	Federal Status	Species determination	Critical Habitat (CH)	Critical Habitat determination
Hybognathus amarus	Rio Grande silvery minnow	Endangered	Not present on the forest. No Effect. (See description below).	No CH in analysis area.	No Effect
Amphibian					
*Plethodon neomexicanus**	Jemez Mountains salamander	Endangered	May affect, likely to adversely affect	CH in analysis area.	May affect, likely to adversely affect.
Plant					
*Ipomopsis sanctispiritus**	Holy Ghost ipomopsis	Endangered	May affect, likely to adversely affect.	No designated CH in analysis area.	May affect, likely to adversely affect.

The proposed action may affect, is likely to adversely affect four listed species that include the Mexican spotted owl, New Mexico meadow jumping mouse, Jemez Mountain salamander and the Holy Ghost ipomopsis. The proposed action may affect, is likely to adversely affect critical habitat for the Mexican spotted owl, New Mexico meadow jumping mouse, Jemez Mountain salamander and the Holy Ghost ipomopsis.

We determined that the following five species are not routinely observed on the Santa Fe NF and no resident populations are known to exist or be impacted by Forest Service management activities addressed in the forest plan: Canada Lynx, Western Yellow-billed cuckoo (western U.S. Distinct Population Segment (DPS)), Southwestern Willow Flycatcher, Least Tern and Rio Grande Silvery Minnow. The rationale for this determination follows:

Canada Lynx (*Lynx canadensis canada*)
On March 24, 2000, the USFWS published the final rule listing the contiguous United States distinct population segment of Canada lynx as a threatened species (65 FR 16052), however Canada lynx is currently under review for delisting due to recovery as of January 2018. Lynx habitat was not ranked as core, secondary, or even peripheral for the Santa Fe NF (USDI USFWS 2005), and critical habitat has not been designated on the Santa Fe (USFWS 2019a). Historically, the Santa Fe did not support a natural resident lynx population and lynx are currently not known to den or breed on the Santa Fe NF. Between 1909 and 2006, the Colorado Division of wildlife released 211 lynx into the San Juan Mountains of southern Colorado. Tracking data identified an individual animal that wandered from Colorado onto the Santa Fe NF however it did not establish residency. The Santa Fe is likely just beyond its southernmost range. In New Mexico, this species is a habitat specialist confined largely to mid- to high-elevation boreal and subalpine spruce-fir forests at 9,800 to 12,000 feet in elevation (Koehler & Brittell 1990; Ruggiero et al. 1999) that can maintain the presence of deep snow.

Snowshoe hare is the primary prey. Lynx do not occur everywhere within the range of snowshoe hares in the contiguous United States (Bittner and Rongstad 1982; McCord and Cardoza 1982). This may be due to inadequate abundance, density, the spatial distribution of hares in some places, the absence of snow conditions that would allow lynx to express a competitive advantage over other hare predators, or a combination of these factors (USFWS 2014). In the southern part of its range, including New Mexico, the low densities of lynx populations are likely a result of naturally patchy habitat and lower densities of their snowshoe hare prey (Griffin 2004; Mills et al. 2005).

In 2008, the Southern Rockies Lynx Management Direction amended seven plans of the national forests in Colorado and southern Wyoming (USDA FS Rocky Mountain Region 2008), but did not

include any national forest in New Mexico. The amendment adopted plan components applicable to vegetation management, livestock grazing, human uses, and linkage areas in order to conserve and promote the recovery of the lynx by reducing or eliminating adverse effects from land management activities on NFS lands while preserving the overall multiple-use direction in existing plans (USDA FS Rocky Mountain Region 2008). In October of 2000, the USFWS issued a biological opinion on the effects of the Southern Rocky Mountains lynx amendment on the distinct population segment of Canada lynx in the contiguous United States. In its 2000 biological opinion, USFWS concluded that the level of adverse effects to lynx that may result from implementation of the Southern Rockies Lynx Management Direction are not reasonably expected to either directly or indirectly appreciably reduce the likelihood of survival and recovery of the lynx distinct population segment in the wild by reducing the reproduction, numbers, or distribution of lynx (USDA FS Rocky Mountain Region 2008). This species is currently not known to den or breed on the Santa Fe NF and is not likely to become established. *Status: Not present on the forest and not likely to become established since the Santa Fe NF is likely below the southern extent of their range.* ***No effect*** *finding was made for Canada lynx.*

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) is a threatened species that could potentially use limited riparian habitat on the Santa Fe NF but is only known as a migrant species. There are no known locations of this species on the Santa Fe NF but slight potential to use bosque areas during migration along the Rio Grande or Jemez River. Critical habitat consists of riparian woodlands with mixed willow-cottonwood vegetation, mesquite-thorn forest vegetation, or a combination of these that contain habitat for nesting and foraging. The cuckoos require contiguous or nearly contiguous patches that are greater than 325 ft. (100 m) in width and 200 ac (81 ha) or more in extent. Habitat patches contain one or more nesting groves, which are generally willow dominated, have above average canopy closure (greater than 70 percent), and have a cooler, more humid environment than the surrounding riparian and upland habitats. These habitat conditions are not known to be present on the Santa Fe NF and there is no critical habitat identified on the forest. *Status: Not present on the forest.* ***No effect*** *finding was made for western yellow-billed cuckoo.*

Southwestern Willow Flycatcher (*Empidonax traillii extimus*) is an endangered species that could potentially use limited riparian habitat on the Santa Fe NF but is only known as a migrant. Habitat includes riparian and wetland thickets, generally of willow, tamarisk, or both, sometimes boxelder or Russian olive. Habitat patches comprising mostly native vegetation account for fewer than half (44 percent) of the known flycatcher territories. Habitat patches as small as 0.5 hectares can support one or two nesting pairs. Nests are typically placed in trees where the plant growth is most dense, where trees and shrubs have vegetation near ground level, and where there is a low-density canopy (NatureServe 2019). In 2008 and 2013, a survey crew from the Bureau of Reclamation documented male flycatchers along the Rio Grande River at the Caja but late season surveys could not document their presence, indicating use of the river primarily as a migration corridor. The Bureau of Reclamation conducted additional studies along the Rio Grande in 2017 and recorded no detections within the Frijoles reach (USDA BOR 2018). This is the portion of the Rio Grande that flows through the Santa Fe National Forest. There is no critical habitat present on the Santa Fe NF. *Status: Not present on the forest.* ***No effect*** *finding was made for Southwestern willow flycatcher.*

Interior Least Tern (*Sterna antillarum*) is an endangered species that has not been documented on the Santa Fe NF. The interior least tern breeds in limited areas along the Pecos River (Bitter Lake National Wildlife Refuge) in eastern New Mexico. The least tern also breeds along the Canadian River (a tributary of the Arkansas River) in the Texas panhandle and Oklahoma. No interior least tern breeding habitat exists within NFS lands in New Mexico, Texas, and Oklahoma. However, least terns

do forage in lakes and ponds within the Black Kettle National Grassland, administered by the Cibola NF in Oklahoma and Texas (USFWS 1990). *Status: Not present on the forest.* ***No effect*** *finding was made for the interior least tern.*

Rio Grande Silvery Minnow (*Hybognathus amarus*) is federally listed as endangered (U.S. Fish and Wildlife Service 1994). The final recovery plan for the silvery minnow was released in July 1999 (U.S. Fish and Wildlife Service 2010). Critical habitat was designated for the silvery minnow on June 6, 2002 and was revised on February 19, 2003. Rio Grande silvery minnow has been extirpated from the Pecos River, and from most of its historical range in the Rio Grande. There are no known populations on the Santa Fe NF because the species does not occur above the dam on Cochiti Reservoir that is on Cochiti Pueblo land. Northern Pike, a highly predatory fish, are in the Rio Grande above the reservoir, making restoration of the minnow above the reservoir highly unlikely. There is no Critical Habitat present on the Santa Fe NF. *Status: Not present on the forest and not likely to become established.* ***No effect*** *finding was made for the Rio Grande silvery minnow.*

Acronyms

AML	appropriate management level
BLM	Bureau of Land Management
BMP	best management practice
CDNST	Continental Divide National Scenic Trail
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRMP	Comprehensive river management plan
CSU	controlled surface use
CWD	coarse woody debris
CWPP	County Wildfire Protection Plan
dbh	diameter at breast height
EPA	Environmental Protection Agency
ERU	ecological response unit
ESA	Endangered Species Act
FSH	Forest Service Handbook
HFRA	Healthy Forest Restoration Act
HUC	Hydrologic Unit Code
IPM	integrated pest management
MIST	minimum impact suppression techniques
ML	maintenance level
MMCF	million cubic feet
MOU	memorandum of understanding
MVUM	motor vehicle use map
NAAQS	national ambient air quality standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NF	National Forest
NFS	National Forest System
NHPA	National Historic Preservation Act
NM	New Mexico
NMAAQS	New Mexico ambient air quality standards
NMDA	New Mexico Department of Agriculture
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NPS	National Park Service
NSO	no surface occupancy
OHV	off-highway vehicle
ORV	outstandingly remarkable value
PM	particulate matter
RD	Ranger District
RMZ	riparian management zone
ROS	recreation opportunity spectrum
SCC	species of conservation concern
TES	Terrestrial Ecosystem Survey
TEU	terrestrial ecosystem unit
TMDL	total maximum daily load
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
WCF	Watershed Condition Framework
WSP	Wilderness Stewardship Performance
WUI	wildland-urban interface

Table of Contents

Introduction

This biological assessment (BA), has been prepared to initiate ESA consultation on a Land Management Plan Revision for the Santa Fe National Forest in compliance with requirements of Section 7 (a) (2) of the Endangered Species Act (ESA). This is alternative 2 in the Final Environmental Impact Statement (FEIS) for the Santa Fe Land Management Plan. Therefor the Santa Fe National Forest Land Management Plan in its entirety (hereafter referred to as the LMP) is the proposed action under consultation. The Santa Fe National Forest LMP was prepared and revised as required by the National Forest and Rangeland Renewable Resources Planning Act of 1974, and as amended by the National Forest Management Act of 1976. Once finalized, the revised LMP will replace the 1986 Santa Fe National Forest LMP and its amendments

Because LMPs do not prescribe the timing or exact location of specific land management activities, there is some uncertainty about the potential environmental consequences of implementing LMP direction. This uncertainty extends to effects on federally listed species and their designated/proposed critical habitats, as well as species that are candidates for Federal listing. Some of the objectives, however, prescribe an annual treatment rate which can be used to describe the timing and intensity of a particular activity or type of action. The determination of effects for each species results from evaluating the expected outcome of implementing LMP direction (i.e., objectives, standard and guidelines, suitability determinations, and management area direction) and assumes that LMP guidance will be followed when site specific land management activities are carried out in the future.

The objectives of this BA are to comply with requirements of § 7(a) (2) of the ESA for the Santa Fe National Forest proposed LMP. This includes reviewing the land and resource management programs to identify ongoing activities and programmatic direction that may affect federally listed, proposed, and candidate species, as well as designated or proposed critical habitats within the Action Area.

Species Considered

The Endangered Species Act (ESA) (16 U.S.C. Sec. 1531-1544), administered by the Department of the Interior, U.S. Fish and Wildlife Service (USFWS), recognizes imperiled species and provides for their protection and recovery. There is one federally threatened species known on the Santa Fe NF, the Mexican Spotted Owl, and three federally endangered species, the Jemez Mountains Salamander, the New Mexico meadow jumping mouse, and the Holy Ghost ipomopsis (USFWS 2019). At present there are no known federal candidate or federal proposed species or federal candidate species on the forest. Three endangered species; the Southwestern Willow Flycatcher, Interior Least Tern and Rio Grande Silvery Minnow are outside the forest boundary but are within watersheds shared by the Santa Fe NF and surrounding lands. None of these species occurs in the plan area. A threatened species, the Western Yellow-Billed Cuckoo could potentially use limited riparian habitat on the Santa Fe NF but is only known as a migrant species and has not been documented on the forest. Canada Lynx, threatened in NM, has not been documented to den or breed on the Santa Fe NF. An individual animal wandering south from Colorado could occasionally use the forest while exploring for territory. However, the snowshoe hare, a primary prey item for lynx, is not abundant on the forest therefore there is an inadequate prey base to support a population of lynx.

Section 7 of the ESA requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to destroy or adversely modify designated critical habitat. Section 7 of the ESA also requires that any Federal agency that carries out, permits, licenses, funds, or otherwise authorizes activities that may affect a listed species must consult with the USFWS to ensure that its actions are not likely to jeopardize the continued existence of any listed species. Five federally listed species, the Canada lynx and western yellow-billed cuckoo (threatened), the southwestern willow flycatcher, Least Tern and Rio Grande silvery minnow (endangered) will not be carried forward in the evaluation. These five species are not established, nor are they likely to become established on the forest. There has also been no critical habitat identified on Santa Fe NF for these species (Table 2).

Table 2. Federally listed threatened or endangered species that are relevant to the plan area

Scientific Name	Common Name	Federal Status	Critical Habitat On Santa Fe NF Designated by USFWS
Mammals			
Lynx canadensis	Canada lynx	Threatened	No Critical Habitat present. No known locations of this species on the Santa Fe NF. Climate change models (Lawler et al. 2009) predict decreased potential for use. Limited prey base to support a population on the Santa Fe NF.
*Zapus hudsonius luteus**	New Mexico meadow jumping mouse	Endangered	Critical Habitat present. Drainages on the west side of the Santa Fe NF have a very small population which was more widespread based on historic museum specimen locations.
Birds			
Coccyzus americanus occidentalis	Western yellow-billed cuckoo	Threatened w of Rio Grande, Distinct Population Segment (DPS)	No Critical Habitat present. No known locations of this species on the Santa Fe NF but slight potential to use the bosque areas during migration along the Rio Grande or Jemez River. Cuckoos typically prefer wide riparian flats of cottonwood or other obligate riparian tree species of 81 hectares or more. The SFNF has few areas meeting these descriptions.
Empidonax traillii extimus	Southwestern willow flycatcher	Endangered	No Critical Habitat present. No known breeding locations of this species on the Santa Fe NF. Occasionally observed migrating through the forest.
*Strix occidentalis lucida**	Mexican spotted owl	Threatened	Critical Habitat present. Several nests sites on the Santa Fe NF. Some sites lost due to large fires.
Sterna antillarum	Least tern	Endangered	No Critical Habitat Present. No known locations of this species on the Santa Fe NF, occurrences during migration in the bosque areas along the Rio Grande, outside the forest boundary.
Fish			
Hybognathus amarus	Rio Grande silvery minnow	Endangered	No Critical Habitat present. There are no known populations on the Santa Fe NF because the species does not occur above the Cochiti Dam, therefore the minnow does not occur in the Rio Grande above Cochiti Reservoir. Northern Pike, a highly predatory fish, are in the Rio Grande above the reservoir making restoration of the minnow highly unlikely.
Amphibian			
*Plethodon neomexicanus**	Jemez Mountains Salamander	Endangered	Critical Habitat present. Endemic to the Jemez Mountains. Restricted to mesic forested habitat.

Scientific Name	Common Name	Federal Status	Critical Habitat On Santa Fe NF Designated by USFWS
Plant			
*Ipomopsis sanctispiritus**	Holy Ghost ipomopsis	Endangered	No Critical Habitat designated or proposed. Endemic to one canyon in the Sangre de Cristo Mountains.

Consultation History

Consultation with the USFWS is required for federal actions that may affect federally listed threatened and endangered species, or proposed species or their critical habitat under the ESA. Although species that are on the candidate list have no formal protections under the ESA, we are also evaluating them to ensure that federal actions would conserve them and contribute towards preventing them from being federally listed. The following summarizes the informal and formal consultation conducted for this biological assessment:

- From 1985 to 1988, each of the 11 NFs in the Southwestern Region developed and approved LRMPs pursuant to the National Forest Management Act (NFMA). The USFWS issued a non-jeopardy/no adverse critical habitat (CH) modification opinion on each of the USFS LRMPs for all federally listed species.

- On April 15, 1993, the MSO was listed as threatened. On September 6, 1995, the USFS requested initiation of formal consultation on the 11 NF Plans for effects on the MSO.

- On May 14, 1996, the USFWS issued a BO on the 11 LRMPs, which concluded jeopardy to the MSO and adverse modification for its designated CH (U.S. Fish and Wildlife Service 1996a). The USFWS's Reasonable and Prudent Alternative to the existing LRMPs advised the USFS to implement the 1995 Recovery Plan for the MSO. This opinion was litigated in US District Court because it did not quantify incidental take for the MSO. On November 25, 1996, the USFWS issued another final jeopardy BO that included incidental take for the MSO pursuant to a September 17, 1996 Court Order. Also, on November 25, 1996, the USFWS issued a BO on the USFS's June 1996 Regional Amendment to the LRMPs for the MSO. The 1996 Regional Amendment directs the implementation of the Recovery Plan for the MSO, as well as guidelines for the northern goshawk and old-growth management. The USFWS concluded non-jeopardy for the MSO and no adverse modification of its designated CH (U.S. Fish and Wildlife Service 1996b).

- On April 5, 2004, the USFS requested re-initiation of formal consultation under section 7 of the ESA on the 1996 MSO opinion and the 1997 opinion for all other federally listed species on the 11 NFs. The USFS provided the USFWS with the final BA for the Continued Implementation of the LRMPs for the Eleven NFs and National Grasslands (NG) of the Southwestern Region.

- On May 26, 2004, the USFWS responded to the USFS, acknowledging formal consultation had been initiated.

- On April 9, 2011 the Santa Fe NF requested re-initiation of consultation on the Forest Service's continued implementation of the Land and Resource management Plans for the 11 Southwestern National Forests and National Grasslands.

- On March 30, 2012, the US Fish and Wildlife Service issued a Biological Opinion (Consultation Number 2012-F-0002) titled "The Continued Implementation of the Land and Resource Management Plan for The Carson National Forest of the Southwestern Region U.S.D.A. Forest Service".

- A Consultation Agreement (CA) between the USFWS and USFS was signed on November 21, 2018, that addressed timeframes, staffing, and a dispute resolution process. As part of the CA, the agencies agreed to organize the BA and BO/CO.

- On July 16, 2019, the USFWS Information for Planning and Consultation (iPaC) website was used to formally request and receive an official species list for the Santa Fe NF administrative forest boundary area.

- On August 22, 2019, USFWS, Santa Fe NF, Cibola NF, and Carson NF Joint Meeting to discuss Forest Plan consultation approaches and timelines.

Description of the Action Area

The Santa Fe NF is one of five national forests in New Mexico. It was established in 1915, when President Woodrow Wilson signed Executive Order 2160, merging the Jemez and Pecos National Forests. Today, the Santa Fe NF administers almost 1.6 million acres and is located in portions of seven counties—Rio Arriba, San Miguel, Sandoval, Santa Fe, Mora, Los Alamos, and only 0.2 acre in Taos County within the Pecos Wilderness (figure 1). The Santa Fe NF is divided into five ranger districts: Coyote, Cuba, and Jemez span the Jemez Mountains and are west of the city of Santa Fe (referred to as the "west side"); Pecos-Las Vegas spans the Sangre de Cristo Mountains east of the city of Santa Fe (referred to as the "east side"); and Española runs down the middle and is located on both east and west sides. The Santa Fe NF shares borders with the Carson National Forest, Bandelier National Monument, Pecos National Historic Park, the Valles Caldera National Preserve, Los Alamos National Laboratories, land administered by the Bureau of Land Management, nine pueblos, one tribal nation, and various land grants. This land management plan (forest plan) covers all the NFS lands within the Santa Fe NF boundary.

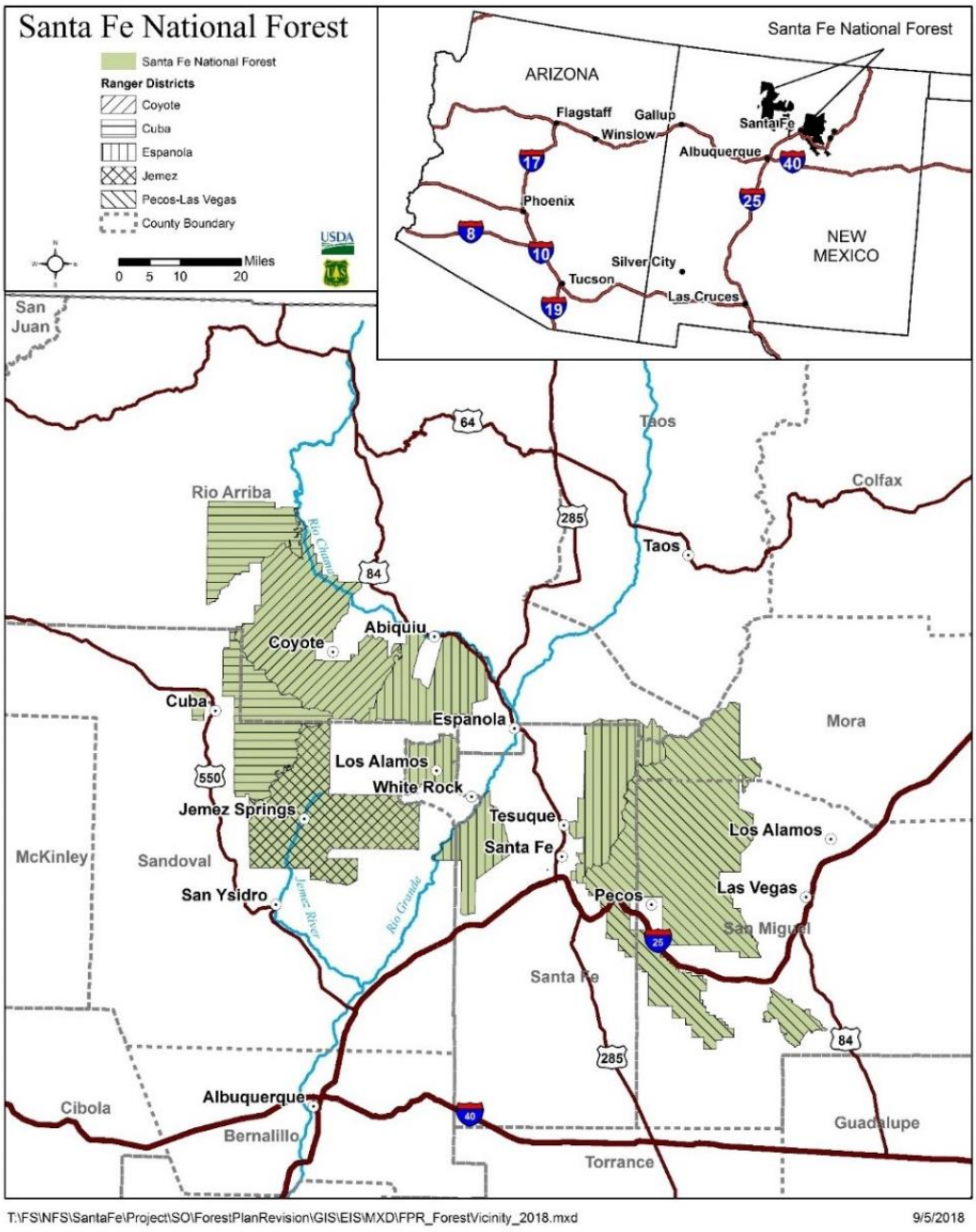


Figure 1. Vicinity of the Santa Fe NF showing county boundaries, major highways, and major rivers. The inset shows the location of the Santa Fe NF within New Mexico.

The action area addressed in this BA includes all lands under the jurisdiction of the Santa Fe NF and all adjacent lands that could be directly or indirectly affected by decisions or actions implemented under the direction of the proposed LMP. The companion documents to this BA are the Forest Plan Revision Final EIS with its effects analysis on all resources and social factors of the area, and the Revised Forest Plan, which established management direction and guidance of all natural resource activities for the planning cycle.

The forest stretches across mountains, valleys, and mesas that can be divided into two fairly distinctive sections: the west side centered on the Jemez Mountains and the east side in the Sangre de Cristo Mountains. Elevation varies from 5,000 to 13,000 feet, with the summit of Truchas Peak (13,108 feet) in the Pecos Wilderness being the highest point on the east side and Chicoma Mountain (11,561 feet) standing the highest on the west side. The majority (95 percent) of the forest lies within the Rio Grande watershed.

Climate across the forest is varied and related to elevational range. Mean daily air temperature for north-central New Mexico ranges from minus 35 degrees Fahrenheit to 14 degrees Fahrenheit in winter and from 30 degrees Fahrenheit to 95 degrees Fahrenheit in summer. Mean annual precipitation for the area ranges from 12 to 35 inches annually, with the highest amounts at the higher elevations. The air is clean and clear, and blue skies are typical with an average of 300 days of sunshine a year. In the higher elevations, first snow usually occurs in October and then covers peaks from late November through spring. It is not uncommon to find snow on high-elevation trails into June. At lower elevations, snow is more variable, with some years receiving substantial amounts (40 inches), while other years have nothing of consequence. Spring is windy and relatively dry. June brings the beginning of monsoons, or the rainy season, which culminate in August. Lightning strikes are common during the summer months, especially on the higher peaks. Fall is marked by golden aspens on mountain sides and cottonwoods along the streams.

Current Ecological Conditions

The following section briefly describes the existing condition of the vegetation resource and related ecological conditions on the Santa Fe NF. Additional information can be found in the FEIS (USDA 2019) and Final Assessment Report Volume 1. Ecological Resources (USDA 2016).

Vegetation – Ecological Response Units (ERU)

The Santa Fe NF encompasses a broad range of ecosystems, including a diversity of vegetative ecosystems, ranging along elevational gradients from prairie grasslands to alpine tundra. These ecosystem types are mapped on the Santa Fe using the ecological response unit (ERU) framework. ERUs are mapped ecosystem types based on biophysical themes that represent the range of conditions (e.g., dominant species, vegetation associations, soils, landscape features, or climate) that prevail under natural disturbance regimes (e.g., fire, insects and disease). Each ERU has specific seral stages that describe smaller units of vegetation conditions and succession (e.g., dominance of post-disturbance species or closed-canopy conditions) that is influenced by both natural processes and management. The seral state proportions given within the desired conditions described for each ERU individually are single values reflecting the seral proportions indicative of reference conditions (LANDFIRE 2010).

Management direction is described for the forest at large (all ERUs) and for individual ERUs. Desired conditions for ERUs are presented at three spatial scales: landscape scale, mid-scale, and fine-scale. Descriptions begin with the landscape scale to provide a “big picture” of the desired conditions across the larger land area (typically composed of variable elevations, slopes, aspects, soils, plant associations, and disturbance processes). Assemblages of mid-scale units comprise a landscape area. Descriptions at the mid- and fine-scales provide additional detail necessary for guiding future projects and activities. The mid-scale is composed of assemblages of fine-scale units, which have similar biophysical conditions. The fine-scale is an area in which the species composition, age, structure, and distribution of plants (single, grouped, or aggregates of groups) are described. Vegetation descriptions at these scales provide adequate detail and guidance for designing projects and activities that will help achieve the desired conditions over

time. For some ERUs (e.g., montane subalpine grasslands, Colorado Plateau Great Basin grasslands) relevant scientific information is more limited, resulting in less applicable information for desired conditions at multiple scales.

Projected trends in the movement of vegetation within ERUs between states (or transitions) were derived through the use of the Vegetation Dynamics Development Tool (VDDT). The VDDT is a software program that provides a state-and-transition model (STM) modeling framework to examine the role of various transition agents, as described above, as well as the effects of management actions that alter vegetative communities (ESSA Technologies Ltd. 2007). STM modeling was completed for the ponderosa pine forest, mixed conifer-frequent fire, pinyon juniper grassland, and juniper grass ERUs. STM modeling was not implemented for the montane subalpine grassland, Colorado Plateau/Great Basin grassland, and sagebrush shrubland ERUs because the STM models were not yet developed for the Santa Fe to analyze these grassland systems. Instead, general qualitative trends were analyzed for these ERUs using the best available science, local records, and expert opinion. These approaches allowed for the quantitative comparison of the effects of vegetation management treatments under each alternative designed to guide plan objectives.

The projected changes to vegetation derived from analyses were given a departure rating based on the degree to which they differed from desired conditions (table 3).

Table 3. Scales of departure for vegetation analysis

Departure	Range (%)
Low	0-33%
Moderate	33-66%
High	66-100%

Relevant Terrestrial Habitats

The Santa Fe NF contains a broad range of ecosystems divided across gradients of moisture and elevation, including grasslands, shrublands, woodlands, forests, and alpine tundra. Plant and animal species depend on these ecosystems to sustain life and diversity, especially within the aquatic and riparian systems (discussed in a separate section) that contain some of the most threatened ecosystems in the arid Southwest. The Santa Fe NF manages more high-elevation vegetation types (spruce-fir forests, mixed conifer forests, montane grasslands, ponderosa pine forests, and sub-alpine grasslands) than other major landowners in the Southwest, with elevations ranging from 5,300 feet to 13,103 feet at the summit of Truchas Peak in the Pecos Wilderness. The forest contains the largest proportion of mixed conifer forests (32 percent) across the Southwestern Region. These exceptional areas of ecological and biological distinction allow for significant opportunities to manage and conserve these vegetation systems in ways that promote biodiversity and resiliency into the future. The primary goal of this forest plan with respect to vegetation, is to manage the forest for ecological integrity and sustainability, while providing for the social and economic needs of human communities that depend on the forest. Eleven upland vegetation types (ERUs) exist in large enough quantities on the Forest to have specific plan components (Table 4).

Table 4. Terrestrial Ecological Response Units (ERUs) of the Santa Fe NF

Ecological Response Unit (ERU)	Abbreviation	System Type	Acres	Percent of Forest
Mixed conifer-frequent fire	(MCD)	Forest	429,967	25.6%
Ponderosa pine forest	(PPF)	Forest	403,915	24.0%

Ecological Response Unit (ERU)	Abbreviation	System Type	Acres	Percent of Forest
Spruce-fir forest	(SFF)	Forest	250,481	14.9%
Piñon-juniper woodland	(PJO)	Woodland	231,507	13.8%
Juniper grass	(JUG)	Woodland	97,469	5.8%
Piñon-juniper grass	(PJG)	Woodland	43,356	2.6%
Colorado Plateau Great Basin grassland	(CPGB)	Grassland	41,639	2.5%
Mixed conifer with aspen	(MCW)	Forest	40,174	2.4%
Sagebrush shrubland	(SAGE)	Shrubland	37,457	2.2%
Piñon-juniper sagebrush	(PJS)	Woodland	30,449	1.8%
Montane subalpine grassland	(MSG)	Grassland	17,707	1.1%
Alpine and tundra	(ALP)	Shrubland/ Mixed	5,015	0.3%
Bristlecone pine*	(BP)	Forest	2,784	0.1%
Gambel oak shrubland*	(GAMB)	Shrubland	1,716	<0.10%
Mixed-grass prairie*	(MGP)	Grassland	1,147	<0.1%
Shortgrass prairie*	(SGP)	Grassland	91	<0.1%
Total Acres			**1,634,874**	**97.3%****

* These ERUs are not discussed in depth within this plan. Individually, they represent less than 1 percent each, and in total comprise less than 2 percent of forest acres, so are not priority targets of direct management efforts over the duration of the plan. Although alpine tundra also represents less than 1 percent of the forest, it was added to the plan based on expressed interest of forest users.

* Riparian (Aquatic) ERUs comprise the remaining 2.7% of the forest.

Ponderosa Pine

The ponderosa pine forest (PPF) vegetation community includes two sub-types: Ponderosa pine-bunchgrass and ponderosa pine-Gambel oak. The PPF vegetation community generally occurs at elevations ranging from approximately 5,000 to 9,000 feet. It is dominated by ponderosa pine and commonly includes other species such as oak, juniper, and piñon. More infrequently, species such as aspen, Douglas-fir, white fir, and blue spruce may also be present as a minor component. This forest vegetation community typically occurs with an understory of grasses and forbs, although it sometimes includes shrubs.

Stands generally have an open structure (less than 30 percent tree cover). Dominant and co-dominant vegetation varies in elevation, moisture availability, and by seral stage. The dominant species in this system is ponderosa pine. Other trees, such as Douglas-fir, white fir, blue spruce, Gambel oak, piñon pine, one-seed juniper, and Rocky Mountain juniper may be present.

PPF seral states on the Santa Fe NF are 97% departed from reference conditions. Just over 70 percent of the landscape has moved into closed-canopy states with 60 percent representation in the medium to large tree states and 11 percent in the small-diameter tree state. Another 11 percent of PPF in the Santa Fe NF is found in the open canopy, medium to large tree states with the limited remaining proportions in early successional states.

PPF patch sizes on the Santa Fe NF are very small in size, with patch size 99% departed from reference conditions. Shifts in overstory structures toward closed canopies and limited disturbance (mortality of overstory trees) has resulted in a significant departure with current patches 72 acres on average in size. With limited variation between local zones, snag densities at the plan scale don’t differ much from any

one local zone with roughly 1 large-diameter (18 inches and greater dbh) snag and 8 smaller-diameter (8.0 to 17.9 inches dbh) snags per acre.

Current PPF seral state proportions have changed significantly toward single-storied, closed-canopy seral states. Current snag density is similar to reference conditions for the large diameter snags, with an excess of smaller diameter snags. These snags, as described in the key ecosystem characteristics descriptions, are beneficial for wildlife and do not pose any additional threat to the ecosystem such as the wildfire hazard from excessive CWD loadings. CWD levels vary slightly across zones, with conditions highly departed from reference conditions overall (79% departure), indicating increases in moderate and high severity proportions.

Current PPF fire return interval (historic 4 to 30 years) has changed considerably and are highly departed (85% departure disturbance regime) with current frequencies closer to 200 years. The severity regime of current fires has also changed across the Forest with 45 percent of resulting severities in the moderate and high classifications.

Mixed Conifer-Frequent Fire

The mixed conifer-frequent fire (dry mixed conifer, MCD) forest vegetation community is transitional with increasing elevation between ponderosa pine and wet mixed-conifer forests and generally occurs at elevations ranging from approximately 6,000 to 9,500 feet. MCD forests are dominated by mainly shade-intolerant trees such as ponderosa pine, southwestern white pine, limber 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.

Dominant and co-dominant vegetation varies in elevation, moisture availability, and by seral stage. Typically these types were historically dominated by ponderosa pine, with minor occurrence of aspen, Douglas-fir, and southwestern white pine. More shade-tolerant conifers, such as Douglas-fir, white fir, and blue spruce tend to be present in late succession stands, depending on site potential.

Seral state proportions have shifted significantly from reference condition proportions, with a 74 percent departure. The biggest shift has been from mid-successional states of medium-sized trees that once accounted for 60 percent of the MCD landscape, towards late successional closed canopy states, which now represents 72 percent of all MCD acres. This is significant considering MCD comprises 25 percent of the Santa Fe NF. Reductions in seral state proportions of early successional states including grass/recently burned lands and aspen deciduous states are also significant changes in this ecosystem. These changes have resulted in an overstory structure that is much more homogenous with a continuous canopy. These changes are also captured in the patch size analysis which captures the change in average patch sizes, from less than one acre to 50 acres historically to the current average of nearly 250 acres (80% departure patch size).

MCD historically had a fire cycle of 5 to 21 years but that has been altered considerably, with a current fire interval of 152 years at the plan scale (86% departure disturbance regime). Factors associated with the alteration in the fire regime are the biggest influences on other key ecological characteristics. The changes in seral state proportions and average patch size result from the alteration of this disturbance regime. Similarly, there has been an immense increase in the amount of CWD (78% departure course woody debris), with loadings of 69 tons per acre on average. These changes in key ecosystem characteristics have resulted in altered fire severities, notably a decrease in low severity effects and an increase in the proportion of high severity effect.

Mixed Conifer with Aspen

The mixed conifer with aspen forest (wet mixed conifer, MCW) vegetation community generally occurs at elevations ranging from approximately 6,500 to 10,000 feet. MCW stands typically occur on north and east aspects, lower slopes, and forested valley bottoms, and are more common at high elevations. 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, southwestern white pine and limber pine, and late seral species such as maple, white fir, and blue spruce. Ponderosa pine may be present in minor proportions. The absence or limited occurrence of Engelmann spruce and corkbark fir distinguishes wet mixed conifer from the spruce-fir forest. Disturbances typically occur at two temporal and spatial scales: large-scale infrequent disturbances (primarily fire), and small-scale frequent disturbances (fire, insect, disease, wind). This forest has an understory of a wide variety of shrubs, grasses, and forbs depending on soil type, aspect, elevation, disturbance, and other factors.

Stands generally have dense structure and dominant and co-dominant vegetation varies in elevation and moisture availability, and by seral stage. Ponderosa pine occurs incidentally or is absent, while Douglas-fir, southwestern white pine, white fir, and Colorado blue spruce occur as dominant and or co-dominant conifer species. Limber pine may be present in subdominant proportions.

MCW exhibits 50% seral state departure from the reference condition. Most MCW is in medium tree size (10.0- to 19.9-inch dbh) seral states in all three local zones (North West Zone (NWZ), South West Zone (SWZ), and North East Zone (NEZ). The NEZ displays the greatest amount of recent higher severity disturbance as 28 percent of all acres found in this zone are in the non-tree/recently burned or seedling/sapling states compared to 12 percent in the NWZ and 11 percent in the SWZ. Snags in MCW are more abundant on the current landscape than what existed historically for both snag size classes. Although snags on the landscape have increased and are a great benefit to wildlife, average patch size in MCW (43% departure patch size) has decreased considerably to an average of 57 acres, potentially fragmenting habitat for MCW dependent species. This may impact species such as the Mexican Spotted Owl and Jemez Mtn. Salamander that may rely on larger patches for all or part of their life-cycle requirements.

Vegetative ground cover is similar to proportions found historically, but proportions in the amount of bare soil have doubled. Coarse woody debris (CWD) loadings have changed significantly and are approaching the high departure category, currently at 64 percent. This large departure in CWD occurs despite current fire return intervals in MCW at the plan scale being consistent with historical occurrences. This is partially a result of the high frequency of fire (24 year cycles) in the NEZ that decrease the average at the plan scale. The skewing of severity effects from the low and moderate categories into the high severity class is likely attributable to the increases in CWD loadings, along with prolonged drought. These changes in structure, composition, and disturbances have led to the MCW type being moderately departed at the plan scale.

Spruce Fir

The spruce-fir forest (SFF) vegetation community generally occurs at elevations ranging from approximately 9,500 to nearly 12,000 feet on Tesuque Peak. It is often dominated by Engelmann spruce, but contains other species depending on elevation. SFF occurs on the coldest and highest elevation sites in the forest with the most precipitation. This forest vegetation community can be subdivided into lower elevation (spruce-fir mix) and upper elevation (subalpine spruce-fir) spruce-fir types, with differing fire regimes and subdominant species composition. The lower spruce-fir type typically occurs between 9,500

and 10,500 feet in elevation, while the upper spruce-fir type typically occurs between 10,500 and about 11,500 feet in elevation and is bounded, where present, by alpine tundra vegetation above 11,500 feet.

Lower-elevation spruce-fir resembles wet mixed conifer with a different composition of tree species, and is a transition zone between wet mixed conifer and the upper-elevation spruce-fir forest type. In the lower type, common seral tree species are aspen, Douglas-fir, white fir, and southwestern white or limber pine. Late seral forest is dominated by Engelmann spruce, white fir, and occasionally blue spruce. Subdominant species may include corkbark (subalpine fir), white fir, and bristlecone pine. In the upper type, dominant tree species are Engelmann spruce, corkbark fir (subalpine fir), but fir may be absent in the colder locations. Patches of aspen are occasionally present, but aspen is typically incidental or co-dominant. Occasional bristlecone pine is also present in the upper elevations. Disturbances in these types typically occur at two temporal and spatial scales: large-scale infrequent disturbances (mostly fire) and small-scale frequent disturbances (fire, insect, disease, and wind).

The seral state proportions in early to mid-seral states are fairly similar to historical proportions. However, the medium (10.0 to 19.9 inch dbh) and large tree (greater than 20.0 inch) seral states exhibit a large shift in proportions relative to reference conditions, shifting from the majority (44 percent) of SFF being in the late seral, large tree states, to 68 percent now in medium tree states (54% seral state departure). Across the Forest, the number of snags per acre has declined in SFF, especially in the smaller diameter class (8.0 to 17.9 inch dbh) where on average there are 12 snags per acre fewer. Despite the number of snags 18.0 inches in diameter and greater being more prevalent on the Forest overall, departure from reference conditions is still moderate (42 percent).

Understory composition is currently in relatively good condition with 32 percent departure but is nearing the moderate departure threshold. Two invasive exotic plants, including Canada thistle and nodding plumeless thistle, contribute to the departure in composition. Ground cover is also in relatively good condition with limited change in vegetative ground cover and a slight increase (0.7) in the percent of bare soil. Like many other ERUs, coarse woody debris loadings have also increased in the SFF. However these changes are not highly pronounced given the already high levels of coarse woody material typically found in these ecosystems. Long fire return intervals and high site productivity are two common causes for high CWD loadings.

Fire frequencies for SFF are just past 200-year cycles and within the historical regime. One change observed in the fire regime is a shift in severity proportions. Historically, low severity fire in SFF was limited and the majority of acres burned exhibited high severity effects. This has shifted to where the majority of acres have burned at low and moderate severity. These changes along with the moderate changes in seral state proportions have resulted in the majority (90 percent) of the SFF type to be classified at a moderate risk of losing key ecosystem characteristics.

Piñon-Juniper Woodlands

Piñon-juniper woodlands (PJO) are mostly found on lower slopes of mountains and in upland rolling hills at approximately 5,300 to 10,000 feet in elevation. They have broad grouping of different plant associations with trees occurring as individuals or in smaller groups and range from young to old, but more typically as large, even-aged structured patches. PJO characteristically has a moderate to dense tree canopy and a sparse understory of perennial grasses, annual and perennial forbs, and shrubs. Post-disturbance development occurs in distinctive phases, ranging from open grass-forb, to mid-aged open canopy, to mature closed canopy. PJO on broken or rocky terrain exhibits little to no natural fire, and insects and disease may be the prominent agents of disturbance. The most common piñon pine is the two-needle piñon. The most common juniper is one-seed juniper; however, there are areas with Utah juniper

and Rocky Mountain juniper. In addition, annual and perennial grasses and graminoids, forbs, half-shrubs and shrubs can be found beneath the woodland overstory.

Open canopy, seedling/sapling and small tree states (states B, C, and E) are overrepresented while the medium to large trees in closed canopy state (state G) is underrepresented. All other seral states are relatively proportional to reference conditions. These proportions and departures are similar to those in JUG ecosystems on the Forest (below). Overall at the plan scale, PJO is in low departure; a result of its long and slow successional pattern. There are currently considerably more snags and CWD as a result of drought and Pine *Ips species* (Engraver Beetles) outbreaks that have strongly impacted piñon pine on the Forest (patch size departure is 41%).

Understory composition has been moderately impacted (36 percent departure) by invasive species such as bull thistle, Russian olive, salt cedar, and Siberian elm. Similarity to site potential has also been influenced by drought and other disturbances that have reduced vegetative ground cover and increased the proportion of bare soil. Partial reductions in vegetative cover can be attributed to the substantial increases in CWD loadings (course woody debris departure is 76%). Despite some fire disturbance in the Central Zone (CZ) and NEZ, the majority of PJO acres in other zones where fire has been almost completely absent have skewed the fire interval to over 1,000-year cycles. In the fires that have occurred, severities have shifted toward lower severities (disturbance regime departure is 54%).

Piñon-Juniper Grass and Juniper Grass

Piñon-juniper grass (PJG) occurs in what were historically more open woodlands with grassy understories (savannah-like conditions). Tree species include two-needle piñon, one-seed juniper, and occasional alligator juniper. Utah juniper also occurs on the Santa Fe, but is not as common as it is in areas farther north and west. Native understories are made up of predominantly cool season perennial grasses including muttongrass, squirreltail, and western wheatgrass combined with both annual and perennial forbs, while shrubs are absent or scarce (less than 1 percent cover). The PJG type is typically found on sites with well-developed, loamy soil characteristics, including gentle upland and transitional valley locations, where soil conditions favor grasses (or other grass-like plants) and other understory plants. Some savannahs apparently have sparse tree cover because of climatic limitations on woody plant growth, though tree growth is generally more productive within this ERU than in juniper grass.

Juniper grass (JUG) is typically found in warmer and drier settings beyond the environmental limits of piñon pine, and just below and often intergrading with the piñon-juniper zone. A dense herbaceous matrix of native grasses and forbs characterize this type. Typical disturbances (fire, insects, and disease) are of low severity and high frequency. These disturbance patterns create and maintain the uneven-aged, open-canopy nature of this type. Typically, native understory grasses are perennial species, while forbs consist of both annuals and perennials. Common native grasses include ring muhly, blue grama, and sideoats grama. Shrubs are characteristically absent or scattered. This type is typically found on sites with well-developed, shallow to moderately deep loamy soil characteristics, generally at the drier edge of the woodland climatic zone. Generally, these types are most extensive in areas dominated by warm (summer) season or bi-modal precipitation regimes.

Departures in seral state compositions align well with departures in snag density, with the CZ and South East Zone (SEZ) displaying conditions more similar to reference. With limited medium to large trees on the landscape, it is expected that large snags would be underrepresented (49% seral state departure). Limited medium sized trees in PJG for the NWZ and SWZ have also led to moderate departures in the density of 8- to 17.9-inch snags in these two zones. Across all ERUs found on the Santa Fe NF, similarity to site potential for JUG represents the most similarity to reference conditions. Although the CZ has the

least departure (39 percent) in seral state proportion, it displays the most departure (36 percent departure) in regards to site potential relative to the other local zones. The NWZ and SEZ show the most similarity to site potential both with 74 percent. The SWZ and CZ not only have had the most change in understory composition but also have had the largest reduction in vegetative ground cover, although moderately departed across all local zones. Despite the changes in composition and cover, the SWZ and CZ display less departure in bare soil relative to the NWZ and SEZ. CWD (93% departure patch size) loadings have significantly increased across all zones but are especially high in the CZ (16.9 tons per acre) and SEZ (15.2 tons per acre).

Decreases in herbaceous material (fine fuels) and increases in bare soil have limited the horizontal fuel continuity and therefore the ability for fire to move across the JUG landscape. This is accentuated by the current long fire intervals as a result of the absence of fire outside of the CZ. Still the CZ is moderately departed with a fire interval of 85 years, well longer than the 8- to 36-year regime that occurred historically. In spite of limited fire, all local zones result in moderate departure.

Colorado Plateau and Great Basin Grasslands

The Colorado Plateau and Great Basin Grasslands (CPGB) are found along elevational and temperature gradients above semi-desert grasslands and below montane-subalpine grasslands. It occupies cooler and wetter sites than semi-desert grasslands. This ERU is typically associated with piñon-juniper grass along the grassland-woodland ecotone in cool climates. Vegetation coverage consists of mostly grasses and interspersed shrubs. Grass species may include but are not limited to Indian ricegrass, threeawn, blue grama, needle and thread grass, spike fescue, muhly, James' galleta, and Sandberg bluegrass. Shrub species may include but are not limited to various species of sagebrush, saltbush, Ephedra, snakeweed, winterfat, one-seeded juniper, Utah juniper and wax currant.

Of all the grass ecosystems found on the SNF, the CPGB ecosystem currently exhibits the greatest departure in overstory structure, from 85 to 95 percent across all local zones where CPGB is found on the Forest. Seral state proportions shifted significantly toward the low/exotic/invaded and low/mid seral states (94% seral state departure). Currently, 61 percent of the CPGB landscape is in a mid-seral state with 37 percent in a low-seral, ruderal invaded state. The shift in ground cover both from alterations in site potential towards exotics and moderate increases in the amount of bare soil have led to fire frequencies well outside the natural range of variability. The removal of this disturbance has not only led to shifts in overstory structure but has also allowed for the encroachment of woody species, which typically would be constrained with regular wildfire. Despite this, patch sizes (295 to 513 acres) in this ecosystem are currently only slightly departed (21 percent) from historical averages.

Unfortunately, the natural role of fire has almost been completely removed from the CPGB ecosystem on the Santa Fe NF with only the NWZ experiencing wildfire in the previous 30 years. The current fire frequency of 446 years well outside the 10- to 30-year cycles that occurred historically (99% departure disturbance regime).

Sagebrush Shrubland

The sagebrush shrubland (SAGE) vegetation community primarily occurs adjacent to Great Basin grassland and piñon-juniper woodland ERUs. The dominant shrub, big sagebrush (*Artemisia tridentata*), consists of a number of important varietie, and wildlife use is associated with specific varieties of big sagebrush due to the chemical variation and forage preference for each variety. Most of the varieties found in the forest include: Basin (*A. t.* ssp. *tridentata*), mountain (*A. t.* ssp. *vaseyana*), and Wyoming (*A. t.* ssp. *wyomingensis*) big sagebrush. These varieties are important as each provide thermal cover and protection, including nesting cover and escape cover for wildlife (e.g., upland birds). Sagebrush can also

make up a significant forage and protein source for wildlife. Other common species include broom snakeweed, shadscale (*Atriplex confertifolia*), and blue grama (*Bouteloua gracilis*). Historically, tree canopy cover exceeded 10 percent, with the exception of early, post-fire plant communities. SAGE sites are usually found on deep well-drained valley bottom soils between 4,800 and 5,800 feet, with precipitation ranging between 10 and 18 inches per year.

The lack of fire disturbance in sagebrush shrublands (greater than 1,000 years fire interval) have led to a significant proportion (39 percent) of the Santa Fe NF SAGE landscape invaded by trees and other woody shrub species. Saab and others (1995) have documented that tree establishment is the result of a combination of causes including historical overgrazing which has limited fine fuel continuity and altered fire regimes and is also a major source of non-native plant incursions into sagebrush habitat. With the increased incursion of non-natives and trees (41% seral state departure), sagebrush vegetative basal area has been reduced by 55 percent. The ground cover analysis indicates much of this area (70 percent) is now bare ground. Increased bare soil leads to increased chance of noxious weed infestation, decreased water infiltration down into the soil profile, increased runoff and erosion, and less vegetative production leading to decreased vegetative cover and further increased bare ground creating a positive feedback cycle.

Despite these changes in the current seral state proportions and percent ground cover, drivers have not led to a significant decrease in average patch size, as the average 152-acre SAGE patch size found on the Forest is on the cusp of the reference range of 152 to 407 acres.

Piñon-Juniper Sagebrush

The piñon-juniper sagebrush (PJS) ERU is concentrated in geographic areas dominated by cold (winter) season precipitation regimes and frigid soils. These systems have a distinct appearance of open woodland canopies interspersed by Colorado Plateau and Great Basin shrub species such as big sagebrush (*Artemisia tridentata;* including subspecies: var: *tridentata*, *vaseyana*, and *wyomingensis*), rubber rabbitbrush (*Ericameria nauseosa*), fourwing saltbush (*Atriplex canescens*), and winterfat (*Krascheninnikovia lanata*). Trees occur as individuals or in relatively small clumps that range from young to old in age (tree clumps are often even-aged). The understory is dominated by moderate to high-density shrubs, and the development of the herb layer is limited and concentrated in canopy openings. The tree and shrub species composition varies throughout the forest; piñon is occasionally absent, but one or more juniper species are always present. Generally, the sparse native understory grass development includes perennial species, while forbs consist of both annuals and perennials. Shrubs are characteristically well-distributed, and usually achieve high canopy closure during mature successional phases or where livestock grazing has favored their development over herb species.

PJS only occurs in two local zones, with the majority found in the CZ. The open canopy, seedling/sapling and small tree states are overrepresented while the closed canopy, small tree state is underrepresented (46% seral state departure). Unlike most other ERUs found on the Forest, snag density is underrepresented (69% patch size departure) in both the small (8.0- to 17.9-inch dbh) and large (greater than 18.0-inch dbh) diameter snag classes.

Ground cover has changed significantly in PJS, with moderate departures in both bare soil (increasing in proportion) and vegetative cover (decreasing in proportion). The reduction in vegetative cover (66% structure and composition departure) and increases in soil have led to the fragmentation of this vegetation type, with current average patch sizes of 16 acres. This represents a significant (high) departure from the 50- to 200-acre average patches found under reference conditions. Fire has been completely absent in PJS on the Santa Fe NF (100% departure from reference conditions in the disturbance regime).

Montane Subalpine Grasslands

The montane subalpine grasslands (MSG) occur at elevations ranging from 8,000 to 11,000 feet as small to large openings within spruce-fir, mixed conifer, and ponderosa pine forests and often harbor several plant associations with varying dominant grasses and herbaceous species. MSG are a mix of grass communities including bunchgrasses, perennial and annual forbs, sod-grasses, and sedges. These grasslands typically have higher herbaceous species richness than adjacent forest and are typically dominated by Arizona fescue, mountain muhly, screwleaf muhly, wheatgrasses, oatgrasses, and Thurber's fescue, depending on soil texture, soil moisture, elevation, exposure (e.g., ridges), and disturbance. Trees and shrubs may occur along the periphery of the grasslands. These grasslands are seasonally wet, which is closely tied to snowmelt, but do not typically experience flooding events.

Departure from reference conditions in MSG seral state proportions substantially relates to a transition towards an uncharacteristic state of shrub and tree invasion. Montane-subalpine grasslands are generally grouped into four vegetative states. The tree and shrub invaded state is found on contemporary landscapes only and is thought to have historically existed only in rare and localized occurrences whereas it is now the dominant state on the landscape (60 percent departure). This woody-encroached condition is a result of a lack of fire in combination with other influences such as drought and recreational impacts. Woody species invasion has fragmented the MSG system, reducing current average patch sizes to 53 acres, roughly half the size that existed historically and moderately departed from reference at the plan scale.

Ground cover analysis for MSG shows that there has been a substantial reduction (41 percent departure) in the amount of vegetation basal area and a significant increase in the amount of bare soil (understory structure and composition, below). Primary causes of these changes include long-term drought intensified by ungulate grazing and human disturbances including road construction, fire suppression/rehabilitation and concentrated recreation. Analysis of site potential also indicates significant alteration in species composition, with a moderate departure of 59 percent. More non-natives, such as Kentucky bluegrass and other invasive species are occupying MSG and less natural vegetation is represented. This departure is significantly greater relative to all other ERUs analyzed.

Fires in MSG are much less frequent on the Santa Fe NF than what occurred historically, and fire return interval (261 years) for this ERU is highly departed. Accordingly, many fire cycles have been missed in this ERU.

Alpine and Tundra

The alpine and tundra (ALP) vegetation community is present on only 5,015 acres in the Santa Fe NF at the highest elevations within the northeastern zone. Alpine areas are typically barren with sparse vegetation including grasses, forbs, lichens, and low shrubs found in the Gelic soil temperature regime. Unstable substrates, exposure to high winds, and a short growing season make it difficult for plants to establish and grow in these areas. Naturally barren areas include rocky outcroppings, scree slopes, and open fell-fields. Open fell-fields may include the following species: mountain sandwort (*Arenaria capillaries*), black and white sedge (*Carex albonigra*), Payson's sedge (*Carex paysonis*), Ross's avens (*Geum rossii*), Bellardi bog sedge (*Kobresia myosuroides*), twinflower sandwort (*Minuartia obtusiloba*), Asian forget-me-not (*Myosotis asiatica*), nailwort (*Paronychia pulvinata*), wherry (*Phlox pulvinata*), creeping sibbaldia (*Sibbaldia procumbens*), and moss campion (*Silene acaulis*).

Within the alpine region, tundra can be found on gradual to moderate slopes, flat ridges, valleys, and basins, where there is fairly stable soil. The tundra system is typically characterized by low-growing, perennial graminoids and forbs, historically with less than 10 percent tree cover. Rhizomatous, sod-forming sedges are the dominant graminoids, and prostrate and mat-forming plants with thick rootstocks

or taproots characterize the forbs. Dominant species include sagebrush (*Artemisia arctica*), sedges (*Carex* spp.), tufted hairgrass (*Deschampsia caespitosa*), fescue grasses (*Festuca* spp.), Ross's avens (*Geum rossii*), Bellardi bog sedge (*Kobresia myosuroides*), wherry (*Phlox pulvinata*), and alpine clover (*Trifolium dasyphyllum*).

The alpine and tundra ERU has a low departure (20 percent) from reference conditions. The gradual encroachment of trees into previously open areas is the biggest diversion from desired conditions addressed, characterizing 20 percent of the acreage. Future changes in temperature or moisture may exacerbate the rate of tree encroachment or promote changes in plant composition and structure by increasing plant stress due to a warmer, drier climate.

Relevant Aquatic Habitats

There are six main riparian ERUs in the Santa Fe NF: herbaceous, narrowleaf cottonwood/shrub, Rio Grande cottonwood/shrub, willow/thinleaf alder, ponderosa pine/willow, and upper montane conifer/willow. Inclusive within these ERUs, or as isolated features on the landscape outside of the ERUs, occur discrete bodies of water such as wetlands, seeps, springs, ponds, lakes and reservoirs, and their associated vegetation composition and structure. Riparian ERUs collectively occupy about three percent of the Santa Fe NF landscape.

Table 5. Riparian Ecological Response Units of the Santa Fe NF

Symbol	ERU	Acres	Percent of Forest
HERB	Herbaceous	**15,373**	0.9%
CWG (cottonwood group)	Narrowleaf cottonwood/shrub	**15,010**	0.9%
	Rio Grande cottonwood/shrub	**7,493**	0.5%
MCWG (mixed conifer/willow group)	Willow/thinleaf alder	**6,957**	0.4%
	Ponderosa pine/willow	**665**	<0.1%
	Upper montane conifer/willow	**495**	<0.1%
	Totals	**45,993**	**2.7%***

* Terrestrial ERUs comprise the remaining 97.3% of the forest.

Herbaceous

The herbaceous (HERB) riparian ERU is the most extensive riparian ERU, occurring at nearly all elevations (5,500 to 12,000 feet) in the Santa Fe NF. Riparian and wetland herbaceous species vary greatly with elevation and climate, but sedges and rushes are particularly important to system function (Neary and Medina 1996). HERB ERUs are common in wide, low-gradient meadows, where the water table is seasonally high with saturated soils, and trees or shrubs are mostly absent (Lemly and Culver 2013).

Decreased flooding, channelization, downcutting, and lowered water tables contribute to a reduction in available soil moisture and an increase in upland species. On NFS lands, instream flows are reduced and their timing is altered by human water uses (Floyd et al. 2009). Road density and other human-caused impacts such as grazing and recreating are likely deteriorating understory composition and condition as site potential and proportion of bare soil are significantly departed at 73 and 60 percent, respectively.

These alterations to the landscape have an impact on wildlife (e.g., reduction in breeding and forage cover). Reduced cover and dominance of sod forming grasses negatively affects stream temperature, bank stability, and sedimentation. Because of the more open habitat, HERB may be the riparian ERU most impacted by invasive species. Invasive exotic plants have been identified in all the local zones. Invasive exotic plants are becoming increasingly established in riparian areas, now distributed by stream flows

(USDA Forest Service 2013a). Uncharacteristic wildfire, including fire suppression activities (e.g., containment lines), also stress this ecosystem, and increased fire severity relative to reference conditions occurs in this ERU.

Narrowleaf cottonwood/shrub

The regional riparian mapping project (RMAP) cottonwood group (CWG) includes eight RMAP types, but only two are found in the Santa Fe NF. Those include 15,010 acres (0.89 percent of plan area) of narrowleaf cottonwood-shrub and 7,493 acres (0.45 percent of plan area) of Rio Grande cottonwood-shrub (RCSH). Narrowleaf cottonwood/shrub is generally found at lower elevations and lacks a spruce-dominated overstory. Rio Grande cottonwood/shrub occurs along low-gradient streams with wider floodplains that provide flood terraces with infrequent flood regimes (Durkin et al. 1995).

The CWG is found across most of the Forest, occurring in all but the Central local zone with most of the acreage found in the North-East and North-West zones. Coarse woody debris and channel organic debris in this ERU are half of what occur in reference conditions or what is necessary to be considered properly functioning.

Less frequent flooding has driven a shift in species composition, with a significant reduction in cottonwood cover, which is highly departed from a habitat perspective. Vegetative ground cover is moderately departed (48 percent). Sod forming grasses are nearly four times more common than bunch grasses. The mechanisms driving a large increase in willow are similar to those in NCSP. The scarcity of perennial streams on the Santa Fe NF limits available habitat for fish in the mountain range. Most streams in which CWG occurs have been affected by historical overgrazing and altered stream nutrient, sediment load, and flow regimes. Flow alterations lead to a shift in species composition, with a significant reduction in cottonwood cover. As a result of human activity, exotic shrubby species such as Russian olive and salt cedar encroach on CWG riparian areas, contributing to a 56 percent departure from site potential.

Mixed conifer/willow group

The mixed conifer/willow group (MCWG) is composed of thinleaf alder plant associations, ponderosa pine/willow and upper montane conifer/willow ERU types. This riparian group stretches along various elevational gradients from lower elevations (3,500 feet) in mountain canyons and valleys to higher mountainous elevations (10,000 feet). At lower elevations, this ERU group can be found along perennial and seasonally intermittent streams. The MCWG riparian ERU frequently occurs in wet drainages associated with thinleaf alder, willow, cottonwood, ponderosa pine and mixed conifer forests. At higher elevations, this ERU is found along streambanks, seeps, fens, and isolated springs, and is shrub- and herb-dominated. MCWG is the least represented riparian ERU group found in the forest. A total of 8,117 acres (0.44 percent) occur in the Santa Fe NF, with the majority composed of thinleaf alder plant associations.

Other Resource Elements Affecting Wildlife

Like the 1987 plan, the proposed action establishes forestwide management goals (desired conditions); emphasizes restore fire resiliency to our forest landscapes, provide clean and abundant water, and connect people to the land and their heritage. The Santa Fe NF identified 12 focus areas that have the greatest needs for new or different plan direction. These are presented first below. Needs for change for additional resources follow and represent additional cases where changes are needed in plan direction (1) Frequent fires, (2) Grass cover, (3) Riparian Ecosystems, (4) Restoration of Ecosystem Resiliency, (5) Water, (6) Soils, (7) Relationships and partners, (8) Range, (9) Recreation, (10) Infrastructure, (11) Land Status and Ownership, (12) Monitoring. Additional resource need for change include; Wildlife, Fish, and Plants, Air,

Socioeconomic Resources, Traditional and Cultural Ways of life, Areas of tribal Importance, Cultural Resources, Extractive multiple uses, Scenery, and Designated areas.

For each resource element, the revised plan describes general conditions necessary to support sustainable ecosystems, biodiversity, and sustainable social and economic interactions between the Santa Fe NF and surrounding communities. It also describes desired outcomes for anticipated tradeoffs or conflicts among resources. In addition to resource and social elements, the revised plan defines desired conditions for specific places (i.e., management areas).

Frequent fires

Fire exclusion and past management activities have limited frequent, low-severity wildfires on the landscape. Wildfire atypical of historic fire regimes has resulted from higher densities of trees, increased fuel loadings, and altered species composition from mature, fire-tolerant species toward shade-tolerant, less fire-resistant species.

It is widely supported and accepted that changes to current fire regimes are in large part due to human activities and have affected species composition, the amount, distribution, and proportion of living and dead biomass, and various ecosystem functions (e.g., nutrient cycling). As a result of European and American settlement around the turn of the 20th century, livestock removed much of the grassy fuels that carried frequent, surface fires; roads and trails have also broken up the continuity of fuels (Covington and Moore 1994b); and because fire for much of the last century was seen as a threat, fire has been actively suppressed and have collectively lead to the departures presented in table 10. Many of the departures in other key ecosystems are also directly and indirectly related to this disturbance process resulting in transformation in forest conditions, structure, and composition. These changes in forest condition further contribute to changes in processes in a feedback cycle. The disruption of natural fire cycles has decreased the diversity within and across stands, permitting conifer seedling encroachment and decrease in meadows. Fire exclusion has also led to greater fuel accumulations (CWD) and stand densities, stand composition conversions (Seral State Proportion/Vegetation Structure), decreasing understory plant productivity (Ground Cover), and fire regime (Fire Frequency and Fire Severity) alterations.

There is a need for:

- Plan direction that recognizes the natural processes of fire and its use as a management tool for vegetation types in the Santa Fe NF and that supports integrated resource objectives.
- Plan direction that allows fire managers the flexibility to manage naturally ignited fires to meet resource objectives based on weather and site-specific conditions (e.g., fuel conditions, topography, safety concerns, and values). These actions may include the use of fire to reduce excess fuels, moderating the risk of future high-intensity fires, improving wildlife and range habitat, encouraging aspen regeneration, and improving watershed and overall forest health.
- Plan direction that includes the flexibility to manage for all resources when managing wildland fire (i.e., prescribed and natural) to accomplish integrated resource objectives.

Grass Cover

Grassland (montane subalpine grasslands and Colorado Plateau/Great Basin grasslands), woodland (juniper grass, piñon-juniper grasslands, piñon-juniper sagebrush), and shrubland (sagebrush shrublands) ERUs have significantly less grass cover and productivity as a result of the exclusion of wildfire as well as legacy (historical) livestock grazing, wildlife grazing, and roads. This lack of cover contributes to reduced water infiltration, accelerated erosion, and declining soil productivity, especially during periods

of drought, and contributes to a cycle that continues to reduce vegetative cover. In addition, native grasses on much of the landscape have been replaced with nonnative and invasive species and are not as effective in preventing erosion or as productive for forage.

The proportion of bare soil and vegetative cover has changed rather significantly as most of the ERUs are moderately departed and a few highly departed from "natural" conditions. The amount of bare soil for all ERUs has increased but mainly the grass- and woodland-ERUs (CPGB, MSG, PJG, PJS, PJO, and SAGE) have the most departure. Mixed conifer with aspen is the only forested type that has experienced moderate or high departure. Conversely, vegetative basal area has decreased across the majority of the ERUs. This is especially significant in the grassland types as vegetative ground cover is the dominant strata and an overstory structure is absent. Spruce-fir is the only ERU to increase in vegetative ground cover, but the departure classification is high. Aside from spruce-fir, the other forested ERUs show low departure from "natural," although ponderosa pine is nearing the moderate departure threshold at 30 percent departure.

There is a need for:

- Desired conditions, standards, and guidelines that allow for the restoration, conservation, and maintenance of grass productivity and diversity, emphasizing native grasses.
- Plan guidance that limits and reverses woody species encroachment into grasslands and infill of scrublands, woodlands, and forested systems.

Riparian Ecosystems

Higher soil moistures, cooler temperatures, and greater productivity typically characterize riparian areas. Riparian systems have been degraded and are at risk across the Santa Fe NF. However, human alterations to the landscape, such as the diversion of waterways, the introduction of invasive plants, unauthorized use by cattle, and heavy recreational impacts are altering these systems.

Historical operations including the removal of beaver, overgrazing by livestock, logging, construction of roads and agriculture in riparian areas, diversion of water for irrigation, and modification of channels have altered riparian areas (54% seral state departure), sometimes irreparably (Dahms and Geils 1997). Vegetative ground cover is moderately departed (39% structure and composition departure). Diversion of water for irrigation and storage and construction of flood control structures have changed the hydrologic cycles on perennial and intermittent streams. Shortly after the period of intensive logging (CWD, 38 percent departure from site potential), surface runoff increased dramatically; now, with dense regeneration and more trees than existed in the pre-settlement forest (34% disturbance regime departure), it is likely that evapotranspiration of water by the trees has reduced the availability of surface water and may have lowered the water table (Dahms and Geils 1997).

Streamflow has generally been reduced, and patterns of erosion and deposition have changed. Where flood control structures have been built, floods are less frequent but more intense when they occur, causing more severe erosion and less deposition of sediment. Sediment deposited by natural floods created seedbeds for willows and cottonwoods, which are now reduced in their regeneration. When floods cut deep channels through alluvial soils in wet meadows, the water flows through more quickly, lowering the water table and draining hydric soils.

There is a need for:

- Desired conditions to restore or maintain characteristics composition and cover of riparian vegetation.

- Standards and guidelines that minimize the ecological impact of multiple uses in riparian areas.
- Management approaches that recognize the reliance of riparian systems on upland ecological health.

Restoration of Ecosystem Resiliency

Resiliency is the ability of an ecosystem to regain structure, composition, and function following disturbance on a time span that is consistent with the dynamics of the ecosystem. At least half of the vegetation types in the Santa Fe NF are highly departed from natural range of conditions for the vegetative characteristics most indicative of systems that are not resilient (fire frequency, seral state proportion, patch size, and coarse woody debris).

There is a need for:

- Plan direction that recognizes the interdependence of resources, provides for management areas that reflect natural features or ecological boundaries, incorporates adaptive management components to better respond to changing environmental conditions, and support an all-lands approach of working with neighboring land managers to implement projects that improve landscape connectivity across mixed ownerships where natural systems span multiple administrative boundaries.
- Desired conditions that promote natural disturbance processes that sustain forest carbon sequestration and emphasize silvicultural practices of uneven-aged management, and standards and guidelines that limit nonnative species, while encouraging native species.

Water

Both natural and human-caused disturbances are having impacts on the condition of the water resource across the forest. Although wildfires are a natural disturbance, the increase in intensity and severity in recent years is having a significant impact on watershed health.

There are 138 sub-watersheds that intersect a significant portion of the Santa Fe NF boundary, 116 subwatersheds were evaluated to determine their condition using the Forest Service WCC Technical Guide. Of those evaluated, 86 percent of the sub-watersheds are in a condition class of 2, "Functioning-at-Risk." Also, based on New Mexico Environment Department's 2012 impaired data, most of the perennial stream segments on the Santa Fe NF have been listed as impaired to anthropogenic influences. Where the listing is human-caused, an opportunity exists for improving the water quality to that perennial stream segment.

There is a need for:

- Plan direction to protect stream channels, hydrological function, and condition of water-dependent systems by maintaining and restoring upland and riparian vegetation cover and reducing erosion and sedimentation from disturbed sites (e.g., reclaiming roads) where feasible.
- Plan direction that provides for sustainable groundwater-dependent ecosystems (e.g., seeps and springs, fens, and wetlands) and for the long-term protection of groundwater quality and quantity in the Santa Fe NF.
- Plan direction that considers consumptive water uses and water rights because water is over-allocated and will continue to be in high demand.

Soils

Soil condition and soil erosion hazard are directly linked to site productivity and soil resilience. Current soil loss rates exceed natural soil loss rates across the Santa Fe NF. The majority of the forest has a high probability for accelerated erosion due to natural disturbances or management disturbances that expose the soil surface without incorporating erosion control measures.

Soil condition is trending away from reference condition on almost half of the Santa Fe NF, and listed as 'unsatisfactory' on 18 percent of the Forest. This trend also negatively impacts water quality as it decreases the ability of soil to filter contaminants and recycle or detoxify wastes in both surface and groundwater systems. Other trends indicating potential risk to sustainable sediment retention services include high departures in fire regimes, and severe and moderate soil erosion hazard ratings on most of the Santa Fe NF. These factors can lead to accelerated erosion, downstream sedimentation and reduced filtering ability by the soil resources.

There is a need for:

- Plan direction that promotes the maintenance and restoration of soil condition and function (e.g., hydrology, stability, and nutrient cycling) by limiting the amount of exposed soil and by restoring and maintaining sufficient vegetative cover.

Relationships and partners

Relationships and effective partnerships are key to the successful implementation of the forest plan that will protect the land and serve the people. There is a need for management approaches:

- To streamline both the processes that leverage partners and volunteers and build stronger relationships with the public, including but not limited to State and Federal agencies, cities and counties, tribal governments, recreational and forest user groups, environmental groups, land grant communities, youth, and vendors.

- That will emphasize public education regarding the Santa Fe NF's diverse ecological, social, and economic resources; the multiple-use philosophy; public laws and regulations; and management strategies.

Range

Vegetation analyses show that the grassland types commonly used for livestock grazing are trending toward unsustainable productivity. Declines in herbaceous ground cover as a result of woody encroachment, and soil compaction and erosion may affect the long-term ability of national forests to sustain the productivity of rangelands. Another risk includes introduced invasive species that out-compete nutritious native forage. Drought is another factor that impacts this resource.

Currently, the majority of the range condition is in satisfactory range management status. However, there are a number of issues with the potential to strongly effect grazing management in the future including the listing of endangered species, drought, and the spread and introduction of invasive species.

There is a need for:

- Plan direction that provides opportunities to use adaptive management for the range program that incorporates ecosystem-based desired conditions, with particular emphasis on strategies to address drought and other extreme weather-related events.

Recreation

The ability of the Santa Fe NF to provide a meaningful recreation program is at risk, reflecting increasing and changing demands in a resource-constrained management environment. The Santa Fe NF provides a diversity of recreational settings and opportunities for users from near and far. Outdoor recreation is important across all ranger districts with use generally heaviest near urban centers. This can be attributed to both the higher resident population and to a trend for shorter visits on national forests, with out-of-area visitors tending to base from urban centers and lodging options and to participate in a wider variety of short activities. Increasing demand for competing and conflicting recreational activities is taxing the Forest's ability to manage use and meet visitor expectations. Recreation areas exceeding design capacity, as well as concentration of users due to displacement from large wildfires, may impact user experience as well as cause resource degradation.

There is a need for:

- Plan direction on sustainable recreation management to provide high-quality recreational experiences that are consistent with the Santa Fe NF's social, environmental, and economical resource capacity, while balancing changing trends in services and intended use of recreation infrastructure and facilities.
- Plan direction to help manage recreation activity impacts to areas sensitive to resource degradation or at risk due to high visitation, and to reduce user conflicts.

Infrastructure

The Santa Fe NF's ability to maintain its current infrastructure is severely threatened. Although there are about 6,900 miles of roads on the landscape, only about 2,200 miles of roads are open to the public for motorized use as per the motor vehicle use map (MVUM). The remaining 4,700 miles of roads may be administrative use roads or non-system roads. Unmaintained or poorly maintained roads contribute to soil erosion and sedimentation, reflecting a critical and growing gap in resources for maintenance. Infrastructure related to rural and agronomic uses, such as timber harvesting, grazing, and rangeland management is also in need of maintenance to better serve their purposes and prevent resource damage.

There is a need for:

- Plan direction to ensure sustainable infrastructure (e.g., roads, recreation and administrative facilities, range improvements, maintenance, etc.) and standards and guidelines that address negative impacts of existing roads.

Wildlife, Fish, and Plants

The Santa Fe NF is home to hundreds of animal, plant, and fungi species. Species rely on habitat within the forest because they may be rare and restricted only to this and other national forests, or because changing land use patterns outside the forest increases their reliance on habitat within the Santa Fe NF.

There is a need for:

- Plan direction that supports restoration and maintenance of ecological conditions that contribute to the recovery and conservation of federally listed species (threatened and endangered), maintaining viable populations of the species of conservation concern, and maintaining common and abundant species.
- Plan direction for terrestrial and aquatic habitat connectivity for species migration and movement.

Air

Although air quality is generally in good condition, visibility and ambient air quality associated with particulate matter can increase with larger, more severe wildfires and increases in fugitive dust. Excessive nitrogen deposition can adversely affect sensitive and aquatic ecosystems as well as cultural resources.

There is a need for:

- Plan direction for air quality in terms of ambient air quality, visibility, and critical loads.

Designated areas

The qualities that led to the designation of these areas contribute to social sustainability by connecting people to their natural and cultural heritage and providing recreation opportunities. These areas also contribute to ecological sustainability by preserving intact natural systems and their individual components.

There is a need for:

- Plan direction to identify and evaluate potential additions to the National Wilderness Preservation System and eligibility for including in the National Wild and Scenic Rivers System.
- Plan direction for designated and recommended wilderness areas is needed to protect and enhance wilderness values and character.

Proposed Action

The proposed action (preferred alternative) analyzed in this BA is the implementation of the management direction provided within the revised LMP. The proposed LMP provides Forest-level direction to meet the Forest Service's mission for program management activities. It is designed to address needs for restored forested and non-forested vegetation, incorporating natural wildfires, wildlife terrestrial and aquatic habitat, improved riparian management zones, watershed health, improved rangeland forage and infrastructure, sustainable recreation, and desires for recommended wilderness and other special areas. This alternative maintains current levels of use while improving infrastructure and increasing the level of restoring ecological health. It is largely strategic in nature but does address types of activities to be conducted on the Forest. The proposed LMP does not specifically authorize individual projects or activities. Site-specific actions will be subject to future and separate ESA section 7(a) (2) consultations.

Also established in the revised plan are objectives, standards, and guidelines for management activities related to many (but not all) specific elements and/or management areas. There are also suggested management approaches for achieving desired conditions. This combination of direction is intended to give a complete picture of desired outcomes and the tools to attain them. It also provides direction for ways to address threats such as invasive species, excessive fuel loading, and climate change, within the authority of the Forest Service. The planning period for the proposed LMP consists is for 10 - 15 years immediately following LMP approval or until the LMP is revised, which ever applies. The proposed LMP includes the following types of direction (i.e., plan components and decisions):

> **Desired conditions--** are goals that express an aspiration, often to achieve long-term ecosystem restoration and resiliency. They form the basis for projects, activities, and uses that will occur under the LMP. Site-specific projects will be designed to maintain or move towards desired conditions over the long term. Desired conditions provided in the proposed LMP include important ecosystem components including airsheds, watersheds, vegetation, aquatic and

terrestrial wildlife, as well as social and cultural resources including recreation, wilderness, scenic beauty, open space, transportation system, and public access and use opportunities for the Forest.

Objectives-- are the short-term mechanisms to reach desired conditions over the long-term. Objectives are generally the actions proposed to reach certain short-term goals over the planning period. Objectives have two parts: a quantifiable outcome and a time in which to achieve the outcome. There is intent to meet the outcome of objectives during the planning period. Although they are considered realistic short-term goals, there may be unforeseen operational, logistical, environmental, political, or financial considerations that may influence the outcome. To accommodate potential uncertainty, there is a stated or implied range of values for the outcome (e.g., acres treated during the proposed action period).

Standards-- set sideboards on the achievement of desired conditions and objectives by setting requirements to limit or guide Forest uses or activities that are expected to occur under the LMP. Standards are activity or project design constraints that must be followed. Thus, standard are mandatory constraint on project and activity decision-making, established to help achieve or maintain the desired condition or conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements.

Guidelines-- set sideboards on the achievement of desired conditions and objectives by setting requirements to limit or guide Forest uses or activities that are expected to occur under the LMP. Guidelines allow for some variance from the exact wording, as long as the intent of the guideline is met. Guidelines are established to help achieve or maintain the desired condition or conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements.

Suitability determinations-- identify areas of land as suitable or unsuitable for the specific uses of timber, livestock grazing, and recreation activities. These relay information about proposed land use activities.

Management area and special designations, or recommendations for special designations, identify areas with differing desired conditions, uses, standards, and/or guidelines than Forest-wide plan direction. Examples include wilderness, botanical areas, and wild and scenic rivers. Management can occur in these areas, so consultation applies to management actions in these areas addressed in the LMP and this BA.

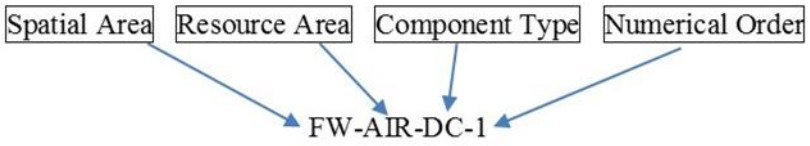
Management Approaches are not plan components but help clarify how plan direction may be applied and identify probable management actions that are designed to maintain or move towards desired conditions and objectives. Management approaches describe the priorities and expectations for future program coordination. Partnerships and collaborative arrangements are also included as part of the management approaches for accomplishing desired conditions. Management approaches are strongly influenced by recent trends, past experiences, anticipated staffing levels, and short-term budgets. Decisions about what projects are actually proposed and approved, as well as details of project design, are determined by public involvement, science, and professional experience at the project or activity level.

Monitoring and evaluation are not plan components but are requirements for LMP implementation. They are used to determine the degree to which on-the-ground management is maintaining or making progress toward desired conditions, evaluate plan implementation effectiveness, and inform adaptive management. Required monitoring and evaluation is part of the proposed actions being consulted on.

Relevant Plan Direction

The forest plan displays plan components in text boxes to distinguish them from other sections of the plan. The forest plan also uses a unique coding system to reference plan components more easily and where the plan components apply using the following pattern: AA-BBB-CCC-NN. The series of letters before the first dash references the spatial area either Forestwide (FW), DA (Designated Area), MA (Management Area), or GA (Geographic Area). The second series of letters references the resource area, management area, or geographic area names. The third series of letters references the type of plan components (i.e., DC for Desired Condition, O for Objective, S for Standard, G for Guideline, and MA for Management Approach). The number (NN) is the sequential order of each plan component within that resource area.

So, the unique coding for Forestwide (FW) Air Resource (AIR) Desired Conditions (DC) number one (1) is FW-AIR-DC-1.



Note: Only direction relevant for assessing effects on analyzed species is listed here. As a result some of the numbers in the tables below are not sequential.

Forestwide Direction for Animal and Plant Species

The Santa Fe NF is primarily responsible for providing habitat to maintain species populations and diversity on NFS lands. The Forest Service has ultimate responsibility over NFS lands, but the New Mexico Department of Game and Fish (NMDGF) and the U.S. Fish and Wildlife Service (USFWS) are the lead agencies responsible for managing most wildlife populations in New Mexico. The USFWS has primary responsibility for managing Federal endangered and threatened species, as well as migratory birds, while the NMDGF is responsible for managing all other protected vertebrates, mollusks, and crustaceans. Terrestrial and aquatic species and habitats are managed in conjunction with other resources according to the Multiple Use Sustained Yield Act of 1960 (Public Law 86-517). For Federal endangered and threatened species in the Santa Fe NF, habitat management and compatible multiple uses are determined in accordance with Section 7 of the Endangered Species Act, as amended (Public Law 93-205).

For each species or group of species, the forest plan considers the extent that ecosystem-level plan components provide for ecosystem integrity and diversity to meet the ecological conditions necessary for those species within their range. Species-specific plan components are added as needed. Wildlife, fish, and plants are grouped into four main categories: aquatic, terrestrial, at-risk, and invasive species. The first three groupings (aquatic, terrestrial, and at-risk) are managed for their persistence in the forest, while the last grouping (invasive) is managed for eradication or control, because they are not native flora and fauna.

Aquatic Species and Habitats

Aquatic plant and animal species include commonly found species that spend all or the majority of their lives in water features in the forest (e.g., streams, springs, and pools) and are usually represented by fish

(e.g., trout, chubs, etc.), amphibians (e.g., frogs, salamanders, etc.), and water-dependent plants (e.g., cattails, lily-pads, etc.) and macro-invertebrates (e.g., aquatic insects, clams, etc.). These animals are both native and non-native to the Santa Fe NF, and their persistence on the forest is desirable.

Desired Conditions for Aquatic Species and Habitats (FW-AQUASH-DC)

1 Aquatic habitats are distributed across the forest in sufficient quantity (redundancy and size) and with appropriate habitat components to support self-sustaining populations of native fish and other aquatic species. Nonnative sportfish are supported in stream reaches where there is strong recreational interest and where they do not conflict with native species repatriation efforts. High-quality habitat consists of:

- a Pool-to-riffle ratio of at least 30 percent of the stream reach.
- b Pool quality with average residual pool depth of 12 or more inches.
- c Less than 20 percent fines (sand, silt, clay) in riffle habitat.
- d Appropriate width-to-depth ratios for the stream channel type (Rosgen or equivalent).
- e Streambank condition is less than 10 percent unstable banks (lineal streambank distance).
- f At least 60 percent of woody riparian cover consists of at least three native plant species or where soil characteristics do not support woody vegetation, native obligate wetland species dominate herbaceous bank cover.
- g In forested streams, large woody debris consists of more than 30 pieces per mile, larger than 12 inches in diameter, and over 35 feet in length.
- h Large-diameter trees and snags near stream channels and riparian areas exist in a quantity that provide for recruitment of large woody material to stream channels.

2 Aquatic habitats and waterbodies (e.g., lakes, ponds, and reservoirs) support a complete assemblage of native aquatic species and are resilient to natural and human disturbances including projected warmer and drier climatic conditions. Habitat resiliency is maintained or increased when:

- a Undesired and invasive aquatic species, as well as introduced pathogens, are rare or absent (per Desired Condition 1 in Wildlife: Nonnative and Invasive Species).
- b Desirable nonnative fish exist in less than 50 percent of aquatic habitats across the forest and provide for a broad range of sport-fishing opportunities.
- c Water quality and quantity meet designated uses, consistent with water rights and site capability.

3 Aquatic habitats are spatially distributed across the forest to support genetically diverse populations of native species and long-term viability.

Desired Conditions for Aquatic Species and Habitats (FW-AQUASH-DC)

4 Aquatic species' habitat conditions provide redundancy necessary to maintain species biodiversity and functioning metapopulations (an interconnected group of subpopulations separated by space but consisting of the same species).

a Aquatic habitats are connected and free from alterations (e.g., temperature regime changes, lack of adequate streamflow, and barriers to aquatic organism passage) to allow for species migration, connectivity of fragmented populations and genetic exchange. Barriers to movement are located where necessary to protect native fish from nonnative species.

Objectives for Aquatic Species and Habitats (FW-AQUASH-O)

1 Complete aquatic restoration on priority projects that restore 30 miles of aquatic habitat (e.g., increase pool quantity, provide stream cover, remove or install fish barriers, restore beaver populations, or treat invasive aquatic species) every 10 years to benefit aquatic species.

2 Every 10 years, restore native fish species to 20 miles of streams where nonnative fish are absent and where natural or human-made fish barriers exist.

Standard for Aquatic Species and Habitats (FW-AQUASH-S)

1 Equipment must not be refueled within or adjacent to the stream channel.

Guidelines for Aquatic Species and Habitats (FW-AQUASH-G)

1 Except where barriers are beneficial and necessary to achieve conservation goals for aquatic species, fragmentation of aquatic habitats and isolation of aquatic species should be avoided and passage for aquatic organisms should be maintained.

2 Human-made structures (e.g., instream structures or fencing) should be maintained to support the purposes for which they were built or removed when no longer needed.

3 Projects and management activities within aquatic and riparian systems should be designed or managed to maintain high-quality aquatic habitats (as per Desired Condition #1).

4 Management of cold water streams should include adequate vegetation cover (as defined by Desired Conditions within the Riparian Ecosystems section) and width-to-depth ratio to move toward State of New Mexico standards for stream water temperatures for "High Quality Coldwater" systems.

5 Management activities negatively impacting vital functions (e.g., reproduction or migration) of native or sport fish species, as well as amphibians, should be avoided except when short-term impacts are required to improve resource conditions and maintain infrastructure.

Management Approaches for Aquatic Species and Habitats (FW-AQUASH-MA)

1. Work collaboratively with the New Mexico Department of Game and Fish, government institutions (local, State, Tribal and Federal), and other organizations, individuals, and groups to plan and implement projects for the management and research of fish and other aquatic species and their habitats.
2. Work with partners to develop and implement conservation strategies beneficial to aquatic habitats (e.g., Rio Grande Cutthroat Conservation Strategy, the State Wildlife Action Plan, etc.).
3. During project planning, consider management actions to mitigate the effects of long-term and short-term climate fluctuations (e.g., climate change, drought, and El Niño Southern Oscillation).

4. Prioritize restoration projects based on factors such as watershed conditions, at-risk species, restoring aquatic habitat connectivity, restoration after disturbances (e.g., fire or flood), partner interest, and other immediate needs.
5. Work with partners to promote public education and valuing of the aquatic wildlife in the forest.
6. Consider constructing beaver dam analogues to create similar beneficial conditions for aquatic and riparian habitats as reintroducing beavers while avoiding potential conflicts with adjacent land management.

Terrestrial Species and Habitats

Terrestrial plant and animal species include commonly found species that spend all or the majority of their time on dry land and are usually represented by mammals (e.g., deer, rabbits, etc.), birds (e.g., eagles, jays, etc.), reptiles (e.g. snakes, lizards, etc.), and land-based plants (e.g., trees, grasses, etc.) and macro-invertebrates (e.g., beetles, snails, etc.). These animals are native to the forest and are not considered invasive nor is their persistence in the forest of concern.

Desired Conditions for Terrestrial Species and Habitats (FW-TERRASH-DC)

1 Terrestrial ecosystems are composed of appropriate (native) assemblages of sustainable populations of plant and animal species that are supported by healthy ecosystems.
   a A diversity of habitat components, including biotic and abiotic features, are available at the appropriate spatial, temporal, compositional, and structural levels (as defined by Desired Conditions for each Vegetation ERU) to provide adequate opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so that forest species remain viable and persistent on the landscape.

   b Undesired nonnative and invasive terrestrial species, as well as introduced pathogens, are rare or absent (per Desired Condition 1 in Wildlife: Nonnative and Invasive Species).

   c Terrestrial habitats allow for the maintenance and promotion of interspecific relationships at all trophic levels (e.g., producer-consumer and predator-prey relationships) across multiple scales, consistent with existing landforms and topography.

2 Habitat configuration, connectivity, and availability allow wildlife populations to adjust their movements in response to major disturbances (e.g., climate change or uncharacteristic fire) and promote genetic flow between wildlife populations.

3 Wildlife are free from harassment and human disturbance at a scale that does not impact vital functions of populations (e.g., breeding, feeding, and rearing young, migration, and dispersal) resulting in a negative impact to the persistence of the species in the forest.

Objectives for Terrestrial Species and Habitats (FW-TERRASH-O)

1 Maintain, improve, or install at least one water feature per year to improve water availability for wildlife or livestock where natural water sources are limited. These water features can serve dual purposes for both wildlife and livestock and can be done in conjunction with objective for water features in range section.

2 Restore or enhance at least 50,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan. This may be done in conjunction with objectives for treatments in the vegetation section.

Standard for Terrestrial Species and Habitats (FW-TERRASH-S)

1 Constructed water features (e.g., water tanks and, cattle guards) must provide safe access and escape for wildlife, such as ramps or other climbing features.

Guidelines for Terrestrial Species and Habitats (FW-TERRASH-G)

1 Human-made structures (e.g., fences, steel posts, or vent pipes) should be constructed and maintained to minimize wildlife mortality (e.g., capped fence posts) and removed when no longer needed.

2 Infrastructure (e.g., fences and roads) should be designed, modified, or removed to minimize impacts on wildlife movement and improve habitat connectivity.

3 Activities negatively impacting wildlife reproduction or other vital functions should be minimized (e.g., closures during elk calving), except if management activities are implemented to control wildlife populations to protect the overall health of the habitat or other populations (e.g., NMDGF regulations).

4 Management activities that inhibit the reproduction of an individual raptor (disturbing the same nest site) should be avoided in successive years (e.g., via the development of species -specific distance buffers focusing around known nest sites).

Management Approaches for Terrestrial Species and Habitats (FW-TERRASH-MA)

1. Work collaboratively with the New Mexico Department of Game and Fish and other organizations, government institutions (local, State, Tribal, and Federal), individuals, and groups to plan and implement projects for the management and research of wildlife and their habitats, including Rocky Mountain bighorn sheep.
2. Collaborate with other adjacent land ownership to encourage an all-lands approach at a scale that improves landscape connectivity across mixed ownerships where natural systems span multiple administrative boundaries.
3. Consider seasonal road restrictions and area closures to provide refuge in small and large blocks of land for a wide range of species.
4. During project planning, consider mitigations to wildlife habitat resulting from the effects of long-term and short-term climate fluctuations (e.g., global climate change, drought, El Niño Southern Oscillation), and subsequent effects of management activities.
5. Work closely with New Mexico Department of Game and Fish, other enforcement agencies and local communities to reduce incidence of poaching (e.g., encourage reporting, increase signage or maintain barriers for road closures).

6. Work with partners to promote public education and valuing of the terrestrial wildlife in the forest.
7. Work collaboratively with New Mexico Department of Game and Fish and New Mexico Department of Transportation as well as other organizations to identify corridors to improve or maintain connectivity for terrestrial species.
8. Work with partners to develop and implement conservation strategies beneficial to terrestrial habitats (e.g., the State Wildlife Action Plan, etc.).

Nonnative Invasive Species

Although the majority of species have evolved in the Santa Fe NF, certain species of terrestrial and aquatic plants and animals are considered invasive and are not desired in the forest. Invasive species include both aquatic and terrestrial plant or animal species that are nonnative (or alien[1]) to the ecosystem under consideration, and which introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112). Invasive species generally possess one or more of the following characteristics: aggressive and difficult to manage; poisonous; toxic; parasitic; a carrier or host of serious insect or disease; and being nonnative, new, or not common to the United States or parts thereof. Invasive species pose an increasing threat to the integrity of ecosystems by decreasing native plant and animal diversity, increasing soil erosion and sedimentation, interfering with natural fire regimes, and threatening the quantity and quality of forest goods and services. Landscapes free of invasive species tend to be more resilient and have a greater capacity to survive natural disturbances in uncertain future environmental conditions, such as those affected by climate change and increasing human uses. Due to their negative impact on the ecosystems, invasive species are managed for their removal or reduction.

Desired Conditions for Nonnative Invasive Species (FW-INVASIVE-DC)

1	Invasive species (including pathogens) are nonexistent or exist at population levels that do not disrupt ecological functioning, affect the sustainability of native species, cause economic harm, or negatively impact human health.
2	Nonnative species do not conflict with the recovery of native species, negatively influence ecosystem function, or detract from existing multiple uses.

Objective for Nonnative Invasive Species (FW-INVASIVE-O)

1	Eradicate or suppress invasive plant species on at least 600 acres annually.

Standards for Nonnative Invasive Species and Habitats (FW-INVASIVE-S)

1	Forest management actions must apply best management practices (e.g., Forest Service Handbook, Region 3 Soil and Water Conservation Practices Handbook) to minimize the introduction or spread of invasive species, including: a Decontamination procedures on vehicles and equipment used in terrestrial and aquatic environments. b Using weed-free products

[1] Some nonnative species are desirable and were intentionally released into the wild to establish self-sustaining populations of wildlife that meet public demands for recreation or other purposes (e.g., sport fishes). These desirable nonnative species are not likely to cause ecosystem disruption and are not addressed in this section.

2 Projects and authorized activities must be designed to reduce the potential for introducing new species or spreading existing invasive or undesirable nonnative species.

3 Agency and permitted pack-animal users must use pelletized feed.

4 Treatment approaches must use integrated pest management practices to treat noxious and invasive species.

Guidelines for Nonnative Invasive Species (FW-INVASIVE-G)

1 Certified, weed-free native seed mixes of local species varieties should be used for revegetation when commercially available. Sterile, nonnative, non-invasive plant material that does not persist long term may be used in limited situations where considered necessary to protect resources and stabilize soils in a timely fashion.

2 Equipment and materials should be stored or staged in areas that are not infested with invasive weeds or other nonnative species.

3 Projects should use locally chipped and shredded woody materials for mulch or, if necessary, use certified weed-free mulch.

4 Management activities should implement procedures to prevent the spread of insects and diseases that impact ecosystem function (e.g., the New Mexico Department of Game and Fish's Aquatic Invasive Species Program and Clean, Drain, and Dry guidelines).

5 As part of project implementation, new populations of invasive species found within the project area should be reported and recorded.

Management Approaches for Nonnative Invasive Species (FW-INVASIVE-MA)

1. Coordinate with the NMDFG and other agencies and pursue partnerships to manage terrestrial and aquatic invasive species.
2. Consider educating and informing the public to prevent the introduction of invasive species and limit their spread.
3. Encourage research on invasive species and pathogens by universities and other organizations and agencies. Coordinate with university research and programs such as the Cooperative Extension Service through New Mexico State University.
4. Consider using the most recent New Mexico Department of Agriculture's "Noxious Weed Memo and List" to identify and prioritize invasive plant management needs. The invasive species with the highest treatment priority are Class A and B noxious weeds, which have made significant increases in their overall population size in the plan area during the last 10 years.
5. Consider programs to address invasive plant species using integrated pest management strategies.
6. Consider encouraging public land users to inspect and clean motorized and mechanized trail vehicles of weeds and their seeds before recreating on public lands.
7. Consider encouraging fishers and hunters to prevent the introduction and spread of invasive species by inspecting their equipment for invasive species and taking preventative measures (e.g., do not use felt-sole wading boots).
8. Consider encouraging public pack-animal users to use pelletized, weed-free feed.

At-Risk Species

At-risk species are found within all the forest's ERUs. Although some plant, invertebrate, and aquatic species may be found in only one specific ERU, most terrestrial at-risk species use multiple ERUs to complete their basic life-cycle needs. Foraging needs and breeding behaviors of at-risk species often require animals to travel considerable distances spanning multiple ERUs. For example, northern goshawk typically nest in ponderosa pine or mixed conifer forests, but are often found feeding in riparian areas; therefore, vegetative conditions trending toward desired conditions in all three of those ERUs will increase or maintain viability for that species.

Although not considered at-risk (federally listed or species of conservation concern), some species need additional protections due to their scarcity or limited habitat. Rare species are those that are very uncommon, scarce, or infrequently encountered even though they may not be endangered or threatened. Endemic species are found only in a given region or location and nowhere else in the world. Although rare and endemic species may not be at-risk, their naturally low population numbers or limited geographic distribution may elicit the need to manage them similar to at-risk species.

Desired Conditions for At-Risk Species (FW-ATRISK-DC)

1 Ecological conditions (physical and biotic) contribute to the survival and recovery of federally listed, proposed, and candidate species; preclude the need for listing new species; and allow for the recovery and persistence of species of conservation concern.

2 Intact, functioning, and sufficient habitat for terrestrial and aquatic at-risk species (defined by Desired Conditions for each Vegetation ERU) provide for opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so the species remains viable and persistent on the landscape.

3 Habitats for at-risk species, including rare and endemic populations, are known (locations) to be intact, functioning, well-connected, and sufficient for species' persistence.

Guidelines for At-Risk Species (FW-ATRISK-G)

1 All authorized activities should be designed and implemented to address threats to at-risk species and their habitats, including, but not limited to:

- a Timing restrictions to encourage reproductive success;
- b Prevention of introduction of non-game invasive, competing, or predatory species (these are species directly and negatively impacting at-risk species populations), and prevention of introduction of nonnative game species to novel locations;
- c Prevention or introduction of pathogens leading to population impacts;
- d Creation or removal of obstructions that may alter natural migration or directly cause mortality to wildlife; and
- e Avoiding or protecting small or isolated populations.

2 Project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan.

3 Where the Forest Service has entered into signed conservation agreements that provide guidance on activities or actions to be carried out by the forest, those activities or actions should be undertaken consistent with the guidance found within those conservation agreements.

4 Within critical habitat for threatened and endangered species, footprints of ground-disturbing fire suppression activities should be as small as possible or located where ground disturbance has previously occurred.

5 The forest should use the most current ecological guidelines to improve nesting conditions for goshawk (*Accipiter gentilis*):

- a A minimum of three goshawk nest areas and three replacement nest areas should be located per goshawk territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (northwest to northeast) aspects. Nest areas should generally be 25 to 30 acres in size.
- b Goshawk post-fledging areas of approximately 420 acres should be designated surrounding nest sites.
- c In goshawk foraging areas and post-fledging family areas, groups of three to five reserve trees should be retained within management-created openings greater than 1 acre in ponderosa pine communities, and six reserve trees (VSS class 5 or 6) should be retained within management-created openings greater than 0.5 acre in spruce-fir communities.
- d In occupied goshawk nest areas, human presence should be minimized between March 1 and September 30 (per Guideline 1a in this section).

6 Management activities along cliff faces, rock features, and other known nesting sites should avoid impacts during nesting season (March 1 through August 15 as per Guideline 1a in this section) to the same nesting site in consecutive years for at-risk bird species.

7 As part of project implementation, new populations of at-risk, as well as rare and endemic species, found within the project area should be reported and recorded.

8 Heavy equipment should be kept out of streams during spawning, incubation, and emergence periods (e.g., spring to early summer for fish species) of aquatic at-risk species (per Guideline 1a in this section) except when short-term uses are required to improve resource conditions and maintain infrastructure.

9 Management of cold water streams with populations of at-risk species should include adequate vegetation cover and width-to-depth ratio to move toward a 7-day average maximum water temperature of less than 17.8 degrees Celsius.

10 In areas that produce piñon seeds, mitigation measures for the collection of forest products (e.g., collection of dead or down, tree diameter restrictions, restrictions on size of fuelwood area) should be used to reduce impacts to piñon-producing trees and benefit at-risk species.

11 Even-aged management treatments in piñon-juniper habitat should avoid creating a sharp, well-defined edge between dense woodlands and recovered shrublands for foraging habitat of at-risk species.

12 Large mature cottonwood trees should be retained as habitat for at-risk species unless necessary to meet management objectives or ensure public safety.

13 Closures or other means to reduce the threat to at-risk species should be implemented in areas where recreational activities (e.g., target shooting or climbing) are known cause harm.

14 Management actions that reduce long-term nesting success or directly harm populations of at-risk bird species in alpine and tundra habitats should be avoided or mitigated.

Management Approaches for At-Risk Species (FW-ATRISK-MA)

1. Work collaboratively with other agencies (e.g., USFWS, NMDGF, New Mexico State Forestry, etc.), universities, and nongovernmental organizations for the research and management of at-risk species. Emphasis is placed on the protection and restoration of key habitats and habitat features that lead to their recovery and persistence.
2. Strive to work with partners to promote public education and valuing of the at-risk species in the forest.
3. Prior to management actions, conduct surveys to identify sessile (immobile) at-risk species in areas with the following features:
    a. Limestone outcropping
    b. Gypsum soils
    c. Sandstone blended with Todilto gypsum or limestone
    d. Gray to red shales and clays of the Mancos and Chinle formations in piñon-juniper woodlands
    e. Volcanic pumice and unconsolidated pyroclastic ash in piñon-juniper woodland and lower montane coniferous forests
4. Consider guidance from regional or local species conservation agreements, assessments, strategies, or guidelines to improve the status of at-risk species.
5. Consider using geographic information systems (GIS) as the preferred database of record to record findings of at-risk species, including negative surveys.
6. In coordination with New Mexico Department of Game and Fish, consider "dusting" prairie dog colonies with flea-controlling powder to reduce the spread of sylvatic plague, or distributing sylvatic plague vaccine. When possible, identify and potentially avoid burrows occupied with at-risk species prior to application.
7. Collaborate with universities, State and Federal agencies (e.g., Forest Service Research and Development, U.S. Geological Survey, Natural Resources Conservation Service, New Mexico State Forestry, New Mexico Department of Game and Fish), and other organizations (e.g., The Nature Conservancy, Natural Heritage New Mexico, Native Plant Society of New Mexico, Trout Unlimited, Audubon Society, and other non-governmental organizations), to obtain data and encourage research on rare and endemic species.
8. Consider alternative measures to projects that may decrease the likelihood of disease introduction or spread to at-risk species (e.g., do not dip firefighting buckets in waterbodies where didymo or whirling disease is known to exist or install drinkers instead of earthen tanks to prevent the spread of Chytrid fungus).
9. Consider working with partners to promote public education and valuing of rare and narrow endemic species in the forest.

Plan Direction from Other Resource Areas

The above-mentioned plan components deal specifically with wildlife. However, multiple resources areas have a tremendous impact on both populations and habitats of individual species. For example, Vegetation (ERU) plan components help construct the baseline habitats for all wildlife. Additionally, recreational uses may have impacts on breeding or nesting activities of bird species. Roads and Facilities may need to be specially designed to reduced wildlife impact and maintain habitat connectivity. There are hundreds of plan components throughout the revised Forest Plan that contribute to the sustained viability of wildlife species. Since this BA will only address the federally listed species, we will refer to all the pertinent plan components in a table under each species analyzed.

Management Areas

Two additional management areas are proposed (see figure 8-west and figure 8-east in the FEIS Volume 1). The Caja del Rio Wildlife and Cultural Interpretive Area lies west of the city of Santa Fe and east of White Canyon recommended wilderness area. This area has important value for its areas of cultural significance, wildlife habitat along the Rio Grande that provides for wildlife connectivity, and relative remote recreation opportunities. Plan direction aims to preserve these characteristics by creating interpretive materials and limiting future development.

The forest plan also includes four cultural interpretive management areas: Nogales Cliff House, Rattlesnake Ridge, Tsipinuouinge, and Poshuouinge (figure 8-west and figure 8-east in the FEIS Volume 1). These sites already receive visitation and management direction is designed to help manage this recreational use, while protecting the cultural sites. …

Recommended Wilderness

The proposed action includes five polygons of recommended wilderness (figure 7 in the FEIS Volume 1) totaling 25,868 acres. These recommended wilderness areas exhibit high wilderness characteristics, no untenable management trade-offs, support from stakeholders, and enhance existing wilderness areas. The Grace Tract area is the same as alternative 1. The Enchanted Lakes area differs from alternative 1 with the eastern half (427 acres) eliminated because it has lower wilderness characteristics and the polygon extended south (480 acres) to take advantage of land acquired since the 1987 Forest Plan. Three additional polygons are added in alternative 2: Thompson Peak borders the existing Pecos Wilderness, Dark Canyon is north of the existing Rio Chama Canyon Wilderness and adjacent to a BLM Wilderness Study Area, and White Rock Canyon is across the Rio Grande from existing wilderness in Bandelier National Park.

Analysis Process and Assumptions

Assumptions

- All of the desired conditions, objectives, standards, and guidelines were reviewed for each species analyzed. Potential effects to species and their proposed or designated critical habitats from adoption of the plan direction were determined. In order to make determinations of effect for the species and critical habitats in this BA, a number of assumptions were made as follows.

- The Santa Fe NF will implement site-specific management actions to move toward these desired future conditions. Funding, priorities, capacity, and other constraints will influence the actual timing, location, extent, and intensity of site-specific management actions, but this cannot be predicted in a program-level analysis.

- Objectives represent a minimum level of activities that may be implemented to move towards or maintain DCs during the 10-15 year life of the LMP. Although many other activities, actions, and projects are expected to be implemented over the life of the LMP, these objectives provide a reasonable expectation of the focus for plan implementation.

- Standards and guidelines in the LMP will be followed when selecting, planning, and executing site-specific management actions. If a site-specific action does not follow the standards and at least the intent of the guidelines, the action must either be modified or the LMP must be amended (either project-specific or full LMP amendment) before the action can be allowed. In the situation where a site-specific action requires LMP amendment, the action would be considered outside of the scope of this consultation and would require its own separate site-specific ESA § 7(a)(2) consultation to address the effects of that particular proposed action.

- The LMP provides a programmatic framework for future site-specific actions, but does not authorize or mandate any site-specific projects or activities.

- LMPs may have indirect effects under a programmatic framework, but do not have direct effects.

- Future site-specific management actions that implement the LMP will be subject to individual NEPA and ESA requirements. Each site-specific project/activity implemented under the revised LMP that may affect a listed species or critical habitat will undergo a separate ESA § 7(a)(2) consultation.

- Law, policy, regulations and applicable best management practices (BMPs) will be followed when planning or implementing site-specific projects and activities.

- Monitoring will occur as described in the monitoring section of the LMP. Based on results, the LMP may be amended, as needed, in the future."

- The Forest will be funded similar to past budget levels (past 5 years).

- The planning timeframe is the 15 years immediately following LMP approval or until the LMP is revised, whichever comes first; other timeframes may be analyzed depending on the resource (usually a discussion of anticipated trends into the future).

- The kinds of resource-management activities allowed under the prescriptions are reasonably foreseeable future actions to achieve the goals and objectives. However, the specific location, design, and extent of such activities are generally not known at the time. The decisions are made on a site-specific (project-by-project) basis. Therefore, the discussions should refer to the potential for the effect to occur and are usually only estimates. The effects analyses are to be useful for comparing and evaluating alternatives on a forest-wide basis. It is not intended to be applied directly to specific locations on the Forest.

- If a species is associated with a particular habitat, then the ecological conditions, amount, and distribution of those habitat elements available to the species on the landscape help to predict its distribution and abundance.

- Abundance and distribution of ecological conditions across the landscape similar to that which supported associated species during past changes in conditions, will likely contribute to their maintenance in the future. Animals have evolved in their habitats, usually under reference vegetative conditions, including specific habitat features. Therefore, habitat abundance, distribution,

and condition similar to that within the reference conditions for the habitats will likely contribute to species maintenance in the future.

- In general, the further ecological condition is departed from desired conditions (natural range of variation), the greater the risk to persistence of associated species. Conversely, the closer ecological condition is to desired conditions, the lower the risk to persistence of associated species. Therefore, comparing the degree to which the alternatives trend conditions toward desired conditions provides a comparison of each alternative's effectiveness at providing ecological conditions that contribute to maintaining species persistence.
- Terms and conditions and reasonable and prudent measures resulting from USFWS consultation on the programmatic framework of the forest plan will be followed when planning or implementing new site-specific projects and activities, unless modified by site-specific consultation.
- Alternatives are evaluated in terms of how well they achieve the same set of desired conditions, regardless of whether the alternative articulates those desired conditions.

Plan Components Directly Affecting Federally Listed Species

The federally listed species addressed in this BA are the New Mexico meadow jumping mouse, Mexican Spotted Owl, Jemez Mountains Salamander, and the Holy Ghost Ipomopsis (USFWS 2019). The following tables reference all plan components within the Santa Fe National Forest Plan that ensure management for persistence for these species (for a detail description of all the at-risk species, please refer to the Santa Fe NF Plan FEIS, Chapter 3).

New Mexico meadow jumping mouse

Zapus hudsonius luteus is federally listed as endangered. The species occurs in dense mid-elevation riparian long grass habitats in the western United States. Proposed critical habitat exists in the Santa Fe NF, and the species has been documented in the forest. The number of historic locations of the species in the forest is greater than outside the forest boundaries. Within the Santa Fe NF, the jumping mice are found in isolated locations along the Rio Cebolla and San Antonio Creek. In 2005 and 2006, the mouse was captured at 5 localities within the Jemez Mountains in northern New Mexico, Sandoval County (Frey 2005a). A study conducted by Carol Chambers 2016-2019 also detected 97 mice along multiple reaches of the Rio Cebolla and the Rio de Las Vacas (Chambers 2019). The major threats faced are the degradation of riparian habitat caused by actions such as grazing livestock, water use and management, drought, post-wildfire flooding events, and unmanaged recreation. Off the forest, agricultural uses and development of land have permanently changed historic locations. The following table references all plan components within the Santa Fe National Forest Draft Plan that ensure management for persistence of the New Mexico meadow jumping mouse (Santa Fe NF Plan FFEIS Vol 2, Chapter 3).

Table 6. Plan Components for New Mexico meadow jumping mouse

Ecological Conditions	**Issues and Threats**	**Coarse-Filter Components** **Desired Conditions**	**Coarse-Filter Components** **Objectives, Standards, Guidelines and Management Approaches**	**Fine-Filter Components** **Desired Conditions, Objectives, Standards, Guidelines and Management Approaches**
Riparian areas	Seral state departure Catastrophic fire Invasive vegetative encroachment Disconnected floodplains Specific ecological features Ground/soil disturbance Intrusive human activity	ALL FW-VEG-DCs, ALL FW-RMZ-DCs, FW-WUI-DC-1, FW-WUI-DC-2, FW-WUI-DC-3, FW-FIRE-DC-1, FW-FIRE-DC-2, FW-FIRE-DC-3, FW-FIRE-DC-4, FW-FIRE-DC-5, FW-FIRE-DC-6, FW-WATER-DC-1, FW-WATER-DC-2, FW-WATER-DC-3, FW-WATER-DC-4, FW-WATER-DC-5, FW-WATER-DC-6, FW-AQUASH-DC-1, FW-AQUASH-DC-2, FW-AQUASH-DC-3, FW-AQUASH-DC-4, FW-TERRASH-DC-1, FW-TERRASH-DC-2, FW-TERRASH-DC-3, FW-INVASIVE-DC-1, FW-INVASIVE-DC-2, FW-SOIL-DC-1, FW-FORESTRY-DC-1, FW-FORESTRY-DC-4, FW-FORESTRY-DC-5, FW-RANGE-DC-4, FW-RANGE-DC-5, FW-RANGE-DC-6, FW-DISREC-DC-2, FW-DISREC-DC-3, FW-RECSU-DC-3, FW-FAC-DC-2, FW-LEASEMIN-DC-1, FW-MINERAL-DC-1, DA-WILD-DC-1, MA-OGLEASE-DC-1, MA-RECWILD-DC-1, GA-CANNAC-DC-1, GA-JEMMC-DC-3, GA-NJEMM-DC-1, GA-WSAN-DC-1	FW-VEG-O-1, FW-VEG-O-2, FW-VEG-G-1, FW-VEG-MA-1, FW-RMZ-O-1, FW-RMZ-S-1, FW-RMZ-G-2, FW-RMZ-G-3, FW-RMZ-G-4, FW-RMZ-G-5, FW-RMZ-G-6, FW-RMZ-G-7, FW-RMZ-G-8, FW-RMZ-G-9, FW-RMZ-G-10, FW-RMZ-MA-2, FW-RMZ-MA-3, FW-FIRE-DC-7, FW-FIRE-G-1, FW-FIRE-G-5, FW-FIRE-G-6, FW-FIRE-G-7, FW-FIRE-G-8, FW-FIRE-G-9, FW-FIRE-MA-6, FW-FIRE-MA-7, FW-FIRE-MA-8, FW-FIRE-MA-9, FW-FIRE-MA-10, FW-FIRE-MA-14, FW-FIRE-MA-12, FW-WATER-O-1, FW-WATER-O-2, FW-WATER-G-2, FW-AQUASH-O-1, FW-AQUASH-G-4, FW-AQUASH-MA-1, FW-AQUASH-MA-2, FW-AQUASH-MA-4, FW-TERRASH-O-1, FW-TERRASH-O-2, FW-TERRASH-G-3, FW-TERRASH-G-4, FW-TERRASH-MA-1, FW-TERRASH-MA-5, FW-INVASIVE-O-1, FW-INVASIVE-S-1, FW-INVASIVE-S-2, FW-INVASIVE-S-3, FW-INVASIVE-S-4, FW-INVASIVE-G-1, FW-INVASIVE-G-2 FW-INVASIVE-G-3, FW-INVASIVE-G-4, FW-INVASIVE-G-5, FW-INVASIVE-MA-1, FW-INVASIVE-MA-2, FW-INVASIVE-MA-3, FW-INVASIVE-MA-4, FW-INVASIVE-MA-5, FW-INVASIVE-MA-6, FW-INVASIVE-MA-7, FW-INVASIVE-MA-8, FW-FORESTRY-S-1, FW-FORESTRY-S-2, FW-FORESTRY-S-4, FW-FORESTRY-G-1, FW-FORESTRY-MA-5, FW-FORESTRY-MA-9, FW-RANGE-O-2, FW-RANGE-S-1, FW-RANGE-G-1, FW-RANGE-G-2, FW-RANGE-G-3, FW-RANGE-G-5, FW-RANGE-MA-6, FW-RANGE-MA-9, FW-RANGE-MA-12, FW-REC-MA-8, FW-DEVREC-G-4, FW-DEVREC-G-6, , FW-DISREC-G-3, FW-DISREC-G-4, FW-DISREC-G-5, FW-DISREC-G-6, FW-DISREC-MA-2, FW-DISREC-MA-4, FW-DISREC-MA-8, FW-ROADS-DC-3, FW-ROADS-DC-5, FW-ROADS-G-2, FW-ROADS-G-3, FW-ROADS-G-4, FW-ROADS-G-8, FW-ROADS-MA-2, FW-FAC-G-2, FW-FAC-G-4, DA-WILD-S-3, DA-WILD-G-4, DA-RNA-S-3, DA-WSR-G-1, DA-WSR-G-2, DA-WSR-G-4, MA-OGLEASE-S-1, MA-OGLEASE-G-2, MA-RECWILD-S-1, MA-RECWILD-G-2	FW-ATRISK-DC-1, FW-ATRISK-DC-2, FW-ATRISK-DC-3, FW-ATRISK-G-1, FW-ATRISK-G-2, FW-ATRISK-G-5, FW-ATRISK-G-6, FW-ATRISK-G-9, FW-ATRISK-G-10, FW-ATRISK-G-11, FW-ATRISK-G-12, FW-ATRISK-G-13, FW-ATRISK-G-14, FW-ATRISK-MA-1, FW-ATRISK-MA-3, FW-ATRISK-MA-4, FW-ATRISK-MA-5, FW-ATRISK-MA-7, FW-ATRISK-MA-8

Mexican Spotted Owl

Strix occidentalis lucida is a federally threatened species known in Coyote, Jemez, Española, and Pecos-Las Vegas Ranger Districts. This species is apparently non-migratory and feeds primarily on small mammals. Young owls, however, are known to disperse long distances. There are 80,487 hectares (198,888 acres) of designated critical habitat in the Santa Fe NF. The Mexican spotted owl requires a variety of mixed conifer habitats, proximity to riparian areas, standing large snags for roosting and nesting, or cavities in vertical canyon walls. The danger of stand-replacing wildland fire was also cited as a threat at that time. Since publication of the 1995 Recovery Plan, we have acquired new information on the biology, threats, and habitat needs of the spotted owl. The primary threats to its population in the U.S. (but likely not in Mexico) have transitioned from timber harvest to an increased risk of stand-replacing wildland fire. Timber harvest, prescribed burning, and other management activities are designed following the Mexican Spotted Owl Recovery Plan 2012, along with consultation with the USFWS. These management activities can still have disturbance affects to the Mexican spotted owl and its habitat. The following table references all plan components within the Santa Fe National Forest Draft Plan that ensure management for persistence of the Mexican spotted owl (Santa Fe NF Plan FEIS Vol 2, Chapter 3).

Table 7. Plan Components for Mexican Spotted Owl

Ecological Conditions	Issues and Threats	Coarse-Filter Components Desired Conditions	Coarse-Filter Components Objectives, Standards, Guidelines and Management Approaches	Fine-Filter Components Desired Conditions, Objectives, Standards, Guidelines and Management Approaches
Mixed-conifer with frequent fire Mixed-conifer with aspen Ponderosa pine forests Riparian areas	Seral state departure Snag density departure Catastrophic fire Specific ecological features	ALL FW-VEG-DCs, ALL FW-MCW-DCs, ALL FW-MCD-DCs, ALL FW-PPF-DCs, ALL FW-RMZ-DCs, FW-WUI-DC-1, FW-WUI-DC-2, FW-WUI-DC-3, FW-FIRE-DC-1, FW-FIRE-DC-2, FW-FIRE-DC-3, FW-FORESTRY-DC-1, FW-FORESTRY-DC-4, FW-FORESTRY-DC-5, FW-MINERAL-DC-1, DA-WILD-DC-1, MA-OGLEASE-DC-1, MA-RECWILD-DC-1, GA-CANNAC-DC-1, GA-NJEMM-DC-1, GA-WSAN-DC-1	FW-VEG-O-1, FW-VEG-O-2, FW-VEG-G-1, FW-VEG-MA-1, FW-RMZ-O-1, FW-RMZ-G-2, FW-RMZ-G-5, FW-RMZ-G-6, FW-RMZ-G-8, FW-RMZ-G-9, FW-RMZ-G-10, FW-RMZ-MA-2, FW-RMZ-MA-3, FW-WATER-DC-6, FW-WATER-O-1, FW-WATER-O-2, FW-WATER-G-2, FW-TERRASH-DC-1, FW-TERRASH-DC-2, FW-TERRASH-O-1, FW-TERRASH-O-2, FW-TERRASH-MA-1, FW-FORESTRY-S-1, FW-FORESTRY-S-2, FW-FORESTRY-G-1, FW-FORESTRY-MA-5, FW-FORESTRY-MA-9, FW-ROADS-G-3, FW-ROADS-G-4, FW-ROADS-MA-2, DA-WSR-G-1, DA-WSR-G-4, MA-OGLEASE-S-1, MA-OGLEASE-G-2, MA-RECWILD-S-1, MA-RECWILD-G-2	FW-ATRISK-DC-1, FW-ATRISK-DC-2, FW-ATRISK-DC-3, FW-ATRISK-G-2, FW-ATRISK-G-5, FW-ATRISK-G-9, FW-ATRISK-G-11, FW-ATRISK-G-12, FW-ATRISK-MA-1, FW-ATRISK-MA-3, FW-ATRISK-MA-4, FW-ATRISK-MA-5, FW-ATRISK-MA-7, FW-ATRISK-MA-8

Jemez Mountain Salamander

Plethodon neomexicanus is a federally endangered species endemic only to the Santa Fe NF. It was listed as endangered in 2013. There are 22,974 hectares (56,770 acres) of designated critical habitat on the Santa Fe NF. It feeds primarily on invertebrates. Threats include habitat loss from severe wildfire or other activities that alter hydrology and disease including chytrid fungus. Grazing is believed to be a vector for chytrid fungus when livestock carry it into the habitat from water sources where it can be present. Wildlife can also carry the fungus now, but did not do so in the past, as chytrid fungus was not known to be present under reference conditions. The following tables references all plan components within the Santa Fe National Forest Draft Plan that ensure management for persistence of the Jemez Mountain salamander (Santa Fe NF Plan FEIS Vol 2, Chapter 3)

Table 8. Plan Components for Jemez Mountain Salamander

Ecological Conditions	Issues and Threats	Coarse-Filter Components Desired Conditions	Coarse-Filter Components Objectives, Standards, Guidelines and Management Approaches	Fine-Filter Components Desired Conditions, Objectives, Standards, Guidelines and Management Approaches
Mixed-conifer with frequent fire Mixed-conifer with aspen Ponderosa pine forests	Catastrophic fire Unnatural disease spread	ALL FW-VEG-DCs, ALL FW-MCW-DCs, ALL FW-MCD-DCs, ALL FW-PPF-DCs, FW-WUI-DC-1, FW-WUI-DC-2, FW-WUI-DC-3, FW-FIRE-DC-1, FW-FIRE-DC-2, FW-FIRE-DC-3, FW-FIRE-DC-4, FW-FIRE-DC-5, FW-FIRE-DC-6, FW-TERRASH-DC-1, FW-TERRASH-DC-2, FW-SOIL-DC-5, MA-RECWILD-DC-1, GA-WSAN-DC-1	FW-VEG-O-1, FW-VEG-O-2, FW-VEG-G-1, FW-VEG-MA-1, FW-FIRE-G-1, FW-FIRE-G-5, FW-FIRE-G-6, FW-FIRE-G-7, FW-FIRE-G-8, FW-FIRE-G-9, FW-FIRE-MA-6, FW-FIRE-MA-7, FW-FIRE-MA-8, FW-FIRE-MA-9, FW-FIRE-MA-10, FW-FIRE-MA-14, FW-TERRASH-O-2, FW-TERRASH-MA-1, FW-TERRASH-MA-4, FW-SOIL-G-2, MA-RECWILD-S-1, MA-RECWILD-G-2	FW-ATRISK-DC-1, FW-ATRISK-DC-2, FW-ATRISK-DC-3, FW-ATRISK-G-1, FW-ATRISK-G-2, FW-ATRISK-MA-1, FW-ATRISK-MA-6, FW-ATRISK-MA-9

Holy Ghost ipomopsis

Ipomopsis sancti-spiritus is a federally endangered plant species found only on the Pecos-Las Vegas Ranger District. It is a narrow endemic species found only in the Holy Ghost Canyon in the Sangre de Cristo mountain range. A Recovery Plan was written for it in 2002, and a Recovery Plan Amendment (USFWS 2019) replacing the previous Recovery Objectives and Criteria was approved on August 28, 2019. The Recovery Plan is being followed with the additional work of State botanists to experimentally plant seedlings to increase the population. Roth (2018) states that, “The core of the recovery effort includes several out-plantings to establish new populations in similar habitats within the tributary canyons of the upper Pecos River. Therefore, recovery efforts have focused on establishing an ex-situ propagation protocol, understanding germination requirements, and successful establishment of plants from seeds and transplants at new locations. In addition, finding new, natural populations is also considered a priority recovery action.” The success of current transplantation efforts is uncertain. The following tables references all plan components within the Santa Fe National Forest Draft Plan that ensure management for persistence of the Holy Ghost ipomopsis (Santa Fe NF Plan FEIS Vol 2, Chapter 3).

Table 9. Plan Components for Holy Ghost ipomopsis

Ecological Conditions	Issues and Threats	Coarse-Filter Components Desired Conditions	Coarse-Filter Components Objectives, Standards, Guidelines and Management Approaches	Fine-Filter Components Desired Conditions, Objectives, Standards, Guidelines and Management Approaches
Mixed conifer with frequent fire Ponderosa pine forests	Catastrophic fire Ground/soil disturbance Intrusive human activity	ALL FW-VEG-DCs, ALL FW-MCD-DCs, ALL FW-PPF-DCs, FW-WUI-DC-1, FW-WUI-DC-2, FW-WUI-DC-3, FW-FIRE-DC-1, FW-FIRE-DC-2, FW-FIRE-DC-3, FW-FIRE-DC-4, FW-FIRE-DC-5, FW-FIRE-DC-6, FW-RMZ-DC-4, FW-TERRASH-DC-1, FW-TERRASH-DC-2, FW-FORESTRY-DC-4, FW-FORESTRY-DC-5, FW-ROADS-DC-3, GA-PECOSRIV-DC-4, FW-LANDSSU-DC-3, FW-LEASEMIN-DC-1, MA-OGLEASE-DC-1	FW-VEG-O-1, FW-VEG-O-2, FW-VEG-G-1, FW-VEG-MA-1, FW-FIRE-G-1, FW-FIRE-G-8, FW-FIRE-G-9, FW-FIRE-G-10, FW-FIRE-G-11, FW-FIRE-MA-6, FW-FIRE-MA-7, FW-FIRE-MA-8, FW-FIRE-MA-9, FW-FIRE-MA-12, FW-FIRE-MA-14, FW-RMZ-O-1, FW-RMZ-S-1, FW-RMZ-G-2, FW-RMZ-G-7, FW-RMZ-MA-2, FW-RMZ-MA-3, FW-SOIL-G-1, FW-TERRASH-O-2, FW-TERRASH-MA-1, FW-SOIL-G-2, FW-FORESTRY-S-1, FW-FORESTRY-G-1, FW-FORESTRY-G-2, FW-FORESTRY-MA-5, FW-ROADS-G-7, FW-ROADS-G-8, FW-ROADS-G-9, FW-ROADS-G-10, FW-LANDSSU-S-2, FW-MINERAL-S-2, DA-ALLDA-G-1, DA-RNA-S-6, DA-RNA-S-8, DA-WSR-G-2	FW-ATRISK-DC-1, FW-ATRISK-DC-2, FW-ATRISK-DC-3, FW-ATRISK-G-1, FW-ATRISK-G-2, FW-ATRISK-G-4, FW-ATRISK-G-8, FW-ATRISK-MA-1

Status of the Species and Effects of the Action

This section presents the analysis of effects on listed species and designated critical habitats from implementation of the revised Santa Fe land management plan. Species assessment for which the Santa Fe seeks concurrence include Canada lynx, western yellow-billed cuckoo, southwestern willow flycatcher, least tern and Rio Grande silvery minnow. Species assessment for which USFS seeks formal consultation include the New Mexico meadow jumping mouse, Mexican spotted owl, Jemez Mountain salamander and Holy Ghost ipomosis. For each species, their natural history, distribution, and status are provided, followed by threats and status in the action area, i.e., threats and status (including relevant existing conditions for the species) within the Santa Fe NF. Primary constituent elements (PCEs) of designated or proposed critical habitat are described, where applicable.

For each species, we consider the effects to the species and its habitat from implementation of the 2020 Forest Plan as guided by its plan components, including desired conditions, standards, and guidelines for

the planning area. The analysis and subsequent discussion address specific plan components targeted for each species and its habitat, as well as key plan components not targeted for each species and its habitat but that still have the potential to affect the species and its habitat.

New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)

- Effects Finding (Species): ***May affect, is likely to adversely affect***
- Effects Finding (Critical Habitat): ***May affect, is likely to adversely affect***

Status of Species and Habitat

Legal Status and Description

Endangered Status for the New Mexico meadow jumping mouse was effective July 10, 2014. The Final New Mexico meadow jumping mouse Species Status Assessment Report (SSA Report; Service 2020, entire), available online at www.regulations.gov, Docket No. FWS–R2–ES–2013–0023, provides a thorough assessment of New Mexico meadow jumping mouse biology and natural history, and assesses demographic risks (such as small population sizes), threats, and limiting factors in the context of determining viability and risk of extinction for the New Mexico meadow jumping mouse The most significant stressors contributing to the status of the subspecies are related to cumulative habitat loss and fragmentation, which has resulted in small, isolated populations. Critical habitat was designated for the New Mexico meadow jumping mouse March 16, 2016. A total designation area of approximately 5,657 hectares (13,973 acres) along 272.4 kilometers (169.3 miles) of flowing streams, ditches, and canals as critical habitat in eight units within Colfax, Mora, Otero, Sandoval, and Socorro Counties in New Mexico; Las Animas, Archuleta, and La Plata Counties in Colorado; and Greenlee and Apache Counties in Arizona.

Critical Habitat and Primary Constituent Elements

Critical habitat primary constituent elements are the physical or biological features essential to the conservation of the species that may require special management considerations or protection. In proposing critical habitat, the USFWS considered verified collections of NMMJM between 2005 and 2012. Critical habitat extends laterally outward from either side of the stream, starting at bankfull, for 100 m or 330 ft.

There are four primary constituent elements of proposed critical habitat for the NMMJM as follows.

a) Riparian Communities

    a. Riparian communities along rivers and streams, springs and wetlands, or canals and ditches characterized by one of two wetland types:

        i. Persistent emergent herbaceous wetlands dominated by beaked sedge (*Carex rostrata*) or reed canarygrass (*Phalaris arundinacea*) alliances; or

        ii. Scrub-shrub riparian areas that are dominated by willows (*Salix spp*.) or alders (*Alnus spp*.);

b) Flowing Water

    a. Flowing water that provides saturate soils throughout the mouse's active season that supports tall (average stubble height of herbaceous vegetation of at least 69 cm (27

inches) and dense herbaceous riparian vegetation (cover averaging at least 61 vertical cm (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 (*Circuta douglasii*), field mint (*Mentha arvense*), asters (*Aster* spp.), or cutleaf coneflower (*Rudbeckia laciniata*);

c) Sufficient Space

   a. Sufficient areas of 9 to 24 km (5.6 to 15 mi) along stream, ditch, or canal that contain suitable or restorable habitat to support movements of individual NMMJM; and

d) Floodplain and Upland Areas

   a. Include adjacent floodplain and upland areas extending approximately 100 m (330 ft.) outward from the water's edge (as defined by the bankfull stage of streams).

Life History and Distribution

Life history, distribution, status of the species range-wide and listing factors are found in documents located on the USFWS website https://www.fws.gov/southwest/es/NewMexico/NMMJM.cfm (accessed 2019). An account of the taxonomy, biology, and reproductive characteristics of this species is found in the 2013 Federal Register proposing endangered species status and the 2013 Federal Register proposing critical habitat for the NMMJM and in the NMMJM draft species assessment report (USFWS 2013).

Distribution, Abundance, and Trend

Eleven jumping mice were captured in the Jemez Mountains in 2005 along San Antonio Creek and the Rio Cebolla (Frey 2005a). An additional three jumping mice were captured at sites along the Rio Cebolla in 2006 (Frey 2007b). Throughout the Rio Cebolla drainage, riparian habitat is fragmented and isolated (Frey 2005a, USFWS 2012a). Populations documented in 2005 and 2006 are likely remnants of a much larger historical distribution that included the Rio de las Vacas, as well as other scattered locations, none of which contain extant populations (Frey 2005a & 2006b). Chambers (2019) surveyed the Jemez Mountains in 2016, 2017, 2018 and 2019; during each study year 8, 21, 23, and 45 jumping mice were captured, respectively for a total of 97 captures.

Threats

The New Mexico meadow jumping mouse requires specific habitat conditions, populations have a high potential for extirpation when habitat is altered or eliminated. Due to the isolation of populations, there is little to no opportunity for natural recolonization (USFW 2020). Threats to jumping mouse habitat include grazing pressure (which removes the needed vegetation), water management and use (which causes vegetation loss from mowing and drying of soils), lack of water due to drought (exacerbated by climate change), wildfires (exacerbated by climate change), drought (also exacerbated by climate change), scouring floods, loss of beaver ponds, highway reconstruction, residential and commercial development, coalbed methane development, and unregulated recreation. Habitat destruction may impact individual jumping mice directly or by destroying nest sites, food resources, and hibernation sites, by disrupting behavior, or by creating a movement barrier.

Conditions of Individuals

Little is known about the condition of individual jumping mice on the Santa Fe. Habitat quality (e.g., the presence of water and saturated soils to support dense riparian herbaceous vegetation) at occupied locales is generally considered sufficient to support the resources necessary for individual jumping mice to complete their life cycle (USDI 2020). This is addressed in the Forest-wide Riparian and Ecosystems Section.

Habitat Connectivity and Patch Sizes

Habitat connectivity and patch sizes influence the suitability of habitat. When habitat is lost, the remaining patches become smaller and more isolated. As habitat patches become more isolated, the amount of intervening unsuitable areas between the suitable habitat patches can exceed an individual's movement or dispersal capability and heighten its vulnerability. Radio collars were deployed on New Mexico meadow jumping mice within Santa Fe NF to develop estimates for home ranges size for males and females (13.03 +/- 3.91 ha and 3.01 +/- 0.74 ha, respectively) (Chambers 2019).

Security from Human Exploitation

Actions that could improve riparian areas would be site-specific, but could include several of the following: removing invasive plant species, stream channel stabilization, restoring hydrologic connectivity between stream channel and riparian area, planting native species, promoting natural revegetation of bare ground, and redirecting other uses (e.g., providing other watering sources, closing areas to camping).

Status of the Species and Habitat in the Action Area

Status of Species within the Action Area

Within the proposed action area of Santa Fe NF in the Jemez Mountain Geographic Management Area, the jumping mice are found in isolated locations along the Rio Cebolla and San Antonio Creek. In 2005 and 2006, the New Mexico meadow jumping mouse was captured at 5 localities within the Jemez Mountains in northern New Mexico, Sandoval County (Frey 2005a). A study conducted by Carol Chambers 2016-2019 also detected 97 New Mexico meadow jumping mice along multiple reaches of the Rio Cebolla and the Rio de Las Vacas (Chambers 2019).

Status of Habitat within the Action Area

There are three subunits comprising the overall geographic management area for the New Mexico meadow jumping mouse on the Santa Fe. All of these sites are within the final critical habitat (see Critical Habitat).

1. **San Antonio Creek Subunit:** This subunit begins along the northern part of San Antonio Creek where it exits the boundary of the Valles Caldera National Preserve and follows the creek about 11.5 km (7.1 mi) through mostly Forest Service lands where it meets private land immediately downstream of the San Antonio Campground. The stream segment surrounding the 2005 capture location (Frey 2005a) is considered occupied; however, it is unknown whether the jumping mouse persists throughout the upstream segment of San Antonio Creek. Because there has only been one population of the jumping mouse found since 2005 in the San Antonio Creek drainage with limited suitable habitat of 0.39 ha (0.96 ac) and it was dry in 2012 and 2013 (USFWS 2012a & 2013e), additional populations are needed to provide connectivity and expand jumping mouse populations.

2. **Rio Cebolla Subunit:** This subunit extends from an old beaver dam about 0.6 km (0.4 mi) north of Hay Canyon downstream about 20.7 km (12.9 mi) where it meets the Rio de las Vacas. The

stream segments surrounding the 2005 and 2006 capture locations (Frey 2005a& 2007b) are considered occupied; however, it is unknown whether the jumping mouse persists throughout the other segments of the Rio Cebolla. Because there have only been six populations of the jumping mouse found since 2005 additional populations are needed to provide connectivity and expand jumping mouse populations throughout the drainage into areas that were historically occupied (Morrison 1985 & 1992, Frey 2005a). Therefore 20.7 km (12.9 mi) in the subunit were included, which would augment the current size and connectivity of suitable habitat to increase the distribution of the jumping mouse in the Jemez Mountains and provide population redundancy and resiliency. The Rio Cebolla in 2012 and 2013, this area did not appear to be currently suitable. Cattle had entered the exclosure where fencing was down and heavy grazing eliminated much of the herbaceous vegetation, leaving mostly bare, dry soils (USFWS 2012a, and 2013e).

3. **Rio del las Vacas Subunit:** This subunit starts about 0.8 km (0.5 mi) north of Forest Road 94 adjacent to Burned Canyon and extends from about 23.3 km (14.5 mi) downstream to the confluence with the Rio Cebolla Subunit. Although much of the habitat was historically occupied with individuals detected as recently as 1989 (Morrison 1985 & 1992, Frey 2005a), no jumping mice were captured during surveys in 2005 (Frey 2005a). This subunit would provide connectivity to the Rio Cebolla and allow for possible expansion of jumping mice from that currently occupied subunit, which is contiguous with the Rio de las Vacas Subunit, into historically occupied habitat along the Rio de las Vacas drainage.

Conservation Measures: Conservation Actions 7 (a)(1)

No specific conservation actions have been implemented for the jumping mouse on the Santa Fe; however, a Forest Plan guideline requires that project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan. Those will be defined, incorporated and implemented in project scale analyses. The proposed action also includes management approaches for at-risk species. These would further help to provide persistence for the mouse throughout its range by promoting collaborative partnerships to aid in recovery and delisting and to consider habitat fragmentation on adjacent lands when planning activities on the Santa Fe. They include the following:

Management Approaches (FW-ATRISK-MA-1 and FW-ATRISK-MA-2)

Effects Analysis for New Mexico meadow jumping mouse

In the individual program areas discussions below, the implication of relevant desired conditions to NMMJM are noted. Potential impacts of each objective, standard, and guideline to the species and habitat are described. Where applicable, management areas are addressed. A determination of effects is then made for that program area. Subsequent to all program areas, an overall determination of effects for this species and its proposed critical habitat from LMP implementation is provided in the Summary of Effects and Determinations section for NMMJM.

Effects of Vegetation Management and Fire and Fuels

Management Common to All Vegetation Types

Under the proposed action, eight ERUs (CPGB, JUG, MCD, MSG, PPF, PJG, SAGE and RIP) are likely to improve the quality of habitat for all wildlife. This is achieved through objectives, standards, and guidelines that combine the use of prescribed fire and mechanical treatments. Grassland (montane subalpine grasslands and Colorado Plateau/Great Basin grasslands), woodland (juniper grass, piñon-

juniper grasslands, piñon-juniper sagebrush), and shrubland (sagebrush shrublands) ERUs have significantly less grass cover and productivity as a result of the exclusion of wildfire as well as legacy (historical) livestock grazing, and roads. This lack of cover contributes to reduced water infiltration, accelerated erosion, and declining soil productivity, especially during periods of drought, and contributes to a cycle that continues to reduce vegetative cover. (All FW-VEG-DC, FW-VEG-O-1, FW-VEG-O-2, All FW-RWE-DC, FW-WUI-DC, FW-FORESTRY-DC), (All FW-RWE-S), (All FW-FIRE-DC),

Under the proposed action, all ERUs would achieve a habitat quality rating of 2 or higher, therefore, allowing for the greatest number of species to meet their basic life cycle needs

Table 10. Objectives are for a 10-year period and include acre ranges specified for mechanical treatments and fire by forested and non-forested vegetation types

Vegetation ERU	Mechanical Treatment (acres)	Prescribed Fire and Naturally Ignited Wildfire (acres)
Mixed conifer with frequent fire (MCD)	10,000-80,000	50,000-200,000
Ponderosa pine (PPF)	15,000-100,000	150,000-250,000
Non-forested*	2,500-50,000	3,800-50,000

* Juniper grass (JUG), piñon-juniper grass (PJG), Colorado Plateau Great Basin grassland (CPGB), and sagebrush shrubland (SAGE)

Although the fire regime condition class does not change for the ponderosa pine, wet mixed conifer, and spruce-fir ERU, each has a trend toward improvement. These ERUs improvements have the potential to reduce the likelihood of wildfire entering riparian habitat and could result in reduced runoff from fires that do occur, provided treatments encompass NMMJM habitat. (All FW-VEG-DC, All FW-RWE-DC), (FW-RWE-O), (FW-RWE-S)

Mechanical treatments and prescribed fire has the potential to result in short term impacts to NMMJM habitat (e.g., loss of floodplain or immediate upland area vegetation), especially if followed by an unpredicted heavy rainfall event. Plan guidelines and standards specific to the use of water placement, heavy equipment for forest management and wildfire prevention also has the penitential of short term impacts to NMMJM habitat.

FW-VEG-G 2 Heavy equipment and log decks should not be staged in ecologically sensitive areas (e.g., riparian corridors, montane meadows, and highly erosive soils).

FW-VEG-G 5 In open grasslands and meadows or in degraded sagebrush shrublands, new stock tanks or wildlife waterers should be strategically placed to improve animal distribution and reduce trampling impacts.

FW-RWE-S 1 Ground-disturbing activities within riparian areas and wetland ecosystems must take measures to avoid introducing new or spreading existing invasive species and pathogens (per Standard 1 in Wildlife: Nonnative and Invasive Species).

FW-FIRE-G 7 Measures should be taken to prevent the spread of invasive plant species by equipment and personnel during fire management and rehabilitation operations.

FS-AQUASH-S 1 Equipment must not be refueled within or adjacent to the stream channel.

FW-FIRE-G 1 Naturally occurring fires should be allowed to perform their natural ecological role to meet multiple resource objectives and facilitate progress toward desired conditions (per desired conditions of various resources throughout the plan).

FW-FIRE-G 5 Wildfire response should be spatially and temporally dynamic, and should be based on a risk management approach that accomplishes integrated resource objectives.

FW-FIRE-G 6 Measures should be taken to prevent entrapment of fish and aquatic organisms and the spread of parasites or disease (e.g., chytrid fungus, Didiymo, and whirling disease), when drafting (withdrawing) water from streams or other waterbodies during fire management activities (Preventing Spread of Aquatic Invasive Organisms Common to the Southwestern Region Technical Guidelines for Fire Operations, Interagency Guidance Rev. August 2009).

FW-FIRE-G 8 Post-fire restoration and recovery should be provided where critical resource concerns merit rehabilitation for controlling the spread of invasive species, protecting areas of cultural concern, protecting critical or endangered species habitat, or protecting other highly valued resources such as drinking water.

FW-FIRE-G 9 Higher fire intensities and associated fire effects at the fine scale (less than 10 acres) should be accepted in areas that are moderately to highly departed from desired conditions. Multiple small areas of high mortality are preferable to a single large, high-severity area.

FW-FIRE-MA 6. Consider the use of planned and unplanned fire in areas such as steep and rugged terrain or remote areas, as this may be the only viable tool where mechanical treatments are not feasible.

FW-FIRE-MA 7. Consider implementing treatments where they provide the most benefit (e.g., values-at-risk) and improve or maintain ecological integrity (e.g., vegetative departure).

FW-FIRE-MA 8. When managing planned ignitions, consider creating conditions that enable future unplanned ignitions to mimic their historical role or to serve as a tool to achieve resource objectives and to move ecosystems closer to desired conditions.

FW-FIRE-MA 9. In areas departed or trending away from desired conditions, consider combining the use of fire with mechanical treatments, as this is often the most effective approach to restoring forest structure and function.

FW-FIRE-MA 10. In areas highly vulnerable to climate change, consider increasing resiliency by using a diversity of treatments to facilitate natural adaptation to changing conditions such as, managing in favor of early- to mid-seral species over late-seral species in ecotones, as species characteristic of lower life zones are adapted for warmer and drier conditions. Consider managing tree basal area at the low end of the range of desired conditions to mitigate water stress.

FW-FIRE-MA 14. Consider collaborating with scientists (e.g. From universities, Forest Service Research and Development, U.S. Geological Survey, or Ecological Restoration Institute) to conduct research on areas impacted by uncharacteristic wildfire to understand how fire has altered the ecological conditions outside the natural range of variation and develop strategies to better manage these areas.

FW-FORESTRY-DC 4 Non-commercial and commercial timber harvest supplement restoration and maintenance treatments at a scale that achieves landscape desired conditions and contribute to watershed restoration function and resilience, wildlife habitat enhancement, small and large business and employment opportunities, and provide wood products.

FW-FORESTRY-S 1 directs that timber harvest must occur only on lands classified as suitable for timber production (16 U.S.C. 1604).

a) On lands suitable for timber production, timber harvest intended to create openings for tree regeneration must only be used when there is reasonable assurance of restocking within 5 years after final regeneration harvest.

b) Timber harvest would occur only where soil, slope, or watershed conditions would not be irreversibly damaged.

c) Timber will be harvested only where protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water.

d) Timber harvest will be carried out consistent with the protection of soil, watershed, fish, wildlife, traditional use resources, cultural and historic resources, recreation, and aesthetic resources.

e) Timber will be harvested only where the harvesting system is not selected primarily because it will give the greatest dollar return or unit output of timber.

FW-FORESTRY-S 2 Harvests to meet resource objectives other than timber production (e.g., fuelwood harvest, protection, and habitat enhancement) are permitted on all lands (i.e., suitable and not suitable).

FW-FORESTRY-S 4 Even-aged regeneration cuts (e.g., clearcutting, seed tree cutting, etc.) during one harvest operation must not exceed 40 acres, unless requirements of both a. and b. and either c. or d. as listed below are met.

a) interdisciplinary team analysis determines clear cuts to be appropriate and the optimum method, and

b) a 60-day public notice and review by the Regional Forester occurs, and

c) it is necessary to achieve the ecological desired conditions in this plan, or

d) harvest is the result of natural catastrophic conditions (e.g., stand-replacing fire, wind storm, or insect or disease outbreak)

FW-FORESTRY-G 1 On suitable timberlands, regeneration harvest of even-aged stands should have reached or surpassed 95 percent of the culmination of mean annual increment, unless it is needed to:

a) Reduce fire hazard within the wildland-urban interface (WUI),

b) Contribute toward achieving the desired uneven-aged vegetation conditions over the long term, or

c) Treats unsustainable stand conditions resulting from insects, disease, or other damage agents.

FW-FORESTRY-G 3 Management activities should use information from the best available science to reduce the likelihood of uncharacteristic insect and disease outbreaks (per Guideline 4 in Wildlife: Nonnative and Invasive Species).

Analysis of Effects:

Mechanical treatments and/or prescribed fire could, over the long term, help reduce uncharacteristic wildfire and the associated risk of substantial or complete loss of riparian and floodplain habitat although activities associated with it and suppression of wildfires could also result in short term impacts to suitable or restorable riparian habitat. Fire events may affect jumping mouse populations by killing individuals and perhaps modifying riparian and adjacent upland habitat on which they depend, the effects to vegetation are often temporary (72 FR 63015, November 7, 2007). Alternatively, fire can result in the loss of dense riparian herbaceous vegetation and result in a shift in the vegetation community to one that is drier and dominated by cattail and bulrush, which is not suitable for the jumping mouse (Frey and Kopp 2013, entire; Service 2013c, entire). Removal of overstory vegetation in areas utilized for hibernation can expose emerging NMMJM to predation. While guidelines could limit impacts, not all negative impacts

are reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* NMMJM and its habitat.

Effects of Watershed and Soil Management

There are 17 relevant desired conditions that guide management and activities within these plan areas. Desired condition for water resources (ALL FW-WATER-DC) directs management to move toward or maintain satisfactory watershed conditions including soil conditions (1b) which could contribute to improved riparian habitat. Desired condition (1c) would help provide habitat that is capable of providing for self-sustaining riparian species populations like NMMJM. This would include floodplains and adjacent upland areas used by nesting or hibernating NMMJM. Desired conditions 4, 5 and 6 would help ensure that water is available and not diminished for the needs of riparian species such as NMMJM. Streambanks, floodplains, and adjacent upland areas would have diverse habitat components needed by NMMJM for hibernation (FW-RWE-DC 1&2). Desired condition (FW-RWE-DC) 1b would provide vegetation supporting NMMJM consists mostly of natives and which is free from invasive plants.

FW-SOIL-DC 1 Soil productivity, function, and inherent physical, chemical, and biological processes remain intact or are enhanced. Soils can readily absorb, store, and transmit water vertically and horizontally; accept, hold, and release nutrients; and resist erosion.

FW-WATER-O 2 Over 10 years, improve watershed function by decommissioning or mitigating impacts (e.g., maintenance, improvements, or reroutes) on at least 100 miles of route (e.g., system roads, unauthorized routes, and trails) to the point of restoring hydrologic and ecological function.

FW-RWE-O1 Riparian ecosystems move toward desired conditions (less than a 33 percent departure from DC) for vegetation functional diversity, vegetation seral state, riparian corridor connectivity, and flood regime (frequency, duration, and magnitude) by implementing 15 miles of stream every 10 years.

Where restoration projects or activities are undertaken within NMMJM habitat, objectives WATER 2 and RWE 1 could potentially improve riparian vegetation composition (native grasses and sedges) and structure (vigorous, tall plant heights) needed by NMMJM habitat. There would likely be short term implementation impacts (e.g., use of equipment to remove invasive conifers from riparian areas).

FW-RWE-O 1 has the potential to help retain and possibly expand potential riparian corridors for NMMJM movements.

The Santa Fe NF includes multiple ERUs classified as riparian vegetation ERUs that may be arranged into three broad groups—the herbaceous group, the cottonwood group, and the montane-conifer willow group. The herbaceous (HERB) group is the most widely distributed category of riparian vegetation in the forest. The two broad classifications of forest and shrub riparian vegetation communities (FSR) are the cottonwood group (CWG) and montane-conifer willow group (MCWG). (FW-RWE-DC, FW-AQUASH-DC)

FW-WATER-S 2 Projects that withdraw water from surface water features or groundwater must ensure that water is maintained at levels that will protect management uses and forest resources, including aquatic species, their habitats, and water quality. Standard 2 has the potential to protect water flows necessary to maintain and support riparian areas that might provide NMMJM habitat.

FW-RWE-S 1 Ground-disturbing activities within riparian areas and wetland ecosystems must take measures to avoid introducing new or spreading existing invasive species and pathogens (per Standard 1 in Wildlife: Nonnative Invasive Species).

FW-AQUASH-S 1 Equipment must not be refueled within or adjacent to the stream channel.

FW-AQUASH-G 1 Except where barriers are beneficial and necessary to achieve conservation goals for aquatic species, fragmentation of aquatic habitats and isolation of aquatic species should be avoided and passage for aquatic organisms should be maintained.

FW-AQUASH-G 4 Management of coldwater streams should include adequate vegetation cover (as defined by Desired Conditions within the Riparian Ecosystems section) and width-to-depth ratio to move toward State of New Mexico standards for stream water temperatures for "High Quality Coldwater" systems.

FW-WATER-G 1 New and reauthorized (e.g., permits and environmental analyses including Sec. 18 reviews) management activities should not negatively impact groundwater quality or quantity to the extent that groundwater-dependent ecosystems are adversely affected

FW-WATER-G 2 Stream channels should not be altered by new management actions unless necessary for resource protection or ecological restoration purposes.

FW-SOIL-DC 2 Vegetative cover and litter are distributed across the soil surface in adequate amounts to limit erosion and contribute to soil deposition, development, productivity, and carbon cycling. Soil cover and herbaceous vegetation protect soil, facilitate infiltration, and contribute to plant and animal diversity and ecosystem function.

FW-SOIL-G 1 Ground-disturbing management activities should be designed to minimize short- and long-term adverse impacts to soil resources (e.g., soil compaction and soil loss). Where disturbance cannot be avoided, project-specific soil and water conservation practices should be developed. When soil conditions are less than satisfactory as a result of management activities, restoration of soil condition should occur.

FW-FAC-G 2 Construction of new facilities in floodplains, wetlands, and other environmentally sensitive areas should be avoided. When this cannot be accomplished in a reasonable manner, the amount and area of disturbance should be as small as practical.

FW-SOIL–G 1 could potentially minimize impacts to soils resources which would potentially reduce impacts like sediment or debris flow into NMMJM habitat.

FW-RWE–G 2 has the potential to help protect riparian/wetland and adjacent resources from soil and vegetation disturbing equipment, vehicles, and activities.

FW-WATER–Guidelines 1, 2, 3 and 4 would encourage projects, activities, and permits to retain sufficient water flows to support riparian vegetation and species which would help retain surface water and protect against the risk of NMMJM habitat loss, consistent with existing rights and law. Erosion control measures (e.g., straw waddles) for landscape scale disturbances have the potential to protect NMMJM habitat after large scale disturbance events such as severe wildfire and flooding.

Analysis of Effects:
This program area could improve overall watershed and riparian conditions and could help limit impacts to riparian/wetland areas providing suitable or restorable NMMJM habitat. While standards and guidelines could help limit impacts from restoration and other activities (e.g., planting vegetation), not all short term negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* NMMJM and its habitat.

Effects of Sustainable Rangelands

There are seven relevant desired conditions that guide management and activities here (FW-RANGE-DC). FW-RANGE Desired conditions 4, 5, and 6 address NMMJM's need for tall, vigorous herbaceous riparian vegetation (cool and warm season growing species), including the need for seedheads. Where annual fluctuations and seasonality of forage production are considered management activities must retain sufficient ground cover to help reduce the ability of overland flow to carry sediment and organic matter into suitable or restorable riparian habitat for the NMMJM (FW-RWE-DC 2).

FW-INVASIVE-O 1 Eradicate or suppress invasive plant species on at least 600 acres annually.

FW-VEG-G 3 In proposed treatment areas with impaired understory vegetation, treatments should be used that improve herbaceous vegetation growth, soil and watershed condition, and increase soil productivity and site-specific vegetation structure.

FW-INVASIVE-S 2 Projects and authorized activities must be designed to reduce the potential for introducing new species or spreading existing invasive or undesirable nonnative species. Standard 2 has the potential to reduce the risk of new or the spread of existing invasive or undesirable species within NMMJM habitat. This could include introduction of plants such as cheatgrass into riparian areas which could possibly displace native vegetation and which increases the risk of fire when it proliferates. Standard 4 has the potential to help limit impacts from activities like control of invasive species within NMMJM habitat.

FW-INVASIVE-G 1 Certified, weed-free native seed mixes of local species varieties should be used for revegetation when commercially available. Sterile, nonnative, non-invasive plant material that does not persist long term may be used in limited situations where considered necessary to protect resources and stabilize soils in a timely fashion.

FW-RANGE-G 1 Forage use should be based on current and desired ecological conditions as determined by temporally and spatially appropriate scientific data during planning cycles (e.g., Annual Operating Instructions or permit renewal), to sustain livestock grazing and maintain ecological function and processes.

FW-RANGE-G 2 Livestock grazing within riparian management zones (RMZ) should be managed to sustain proper stream channel morphology, floodplain function, and riparian vegetation desired conditions

FW-RANGE-G 3 New livestock troughs, tanks, and holding facilities should be located to avoid long-term detrimental impacts to RMZs unless necessary for resource enhancement or protection

FW-RANGE-G 5 Salting or mineral supplementation should not occur on or adjacent to areas especially sensitive to salt and increased ungulate traffic (e.g., riparian areas, wetlands, archeological sites, and at-risk species present) to protect these sites.

FW-RANGE-O 2 Maintain, improve, or install at least one water feature per year to improve water availability for wildlife or livestock where natural water sources are limited.

FW-RANGE-S 1 Livestock management must be compatible with capacity and address ecological resources (e.g., forage, invasive plants, at-risk species, soils, riparian health, and water quality) that are departed from desired conditions, as determined by temporally and spatially appropriate data.

Analysis of Effects:

The Proposed Action maintains or improves the riparian habitats and will also reduce unnecessary stressors caused by external influences (human disturbance).Changes in natural hydrologic disturbance regimes and patterns of sediment transport include alteration of the timing of downstream flow,

attenuation of peak flows, and other effects. Such alterations can result from grazing in riparian management zones, dam construction, from diversions, or by water removal from rivers for irrigation or other consumptive uses, often in combination. The increased restoration through the proposed actions will also improve upland characteristics and reduce the potential for catastrophic fire. While standards and guidelines could limit management impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* NMMJM and its habitat.

Effects of Infrastructures, Roads and Trails

Relevant desired condition that guides management and activities include Facilities, Roads, Recreation (Dispersed and Developed) and special uses **(**FW-ROADS-DC, FW-RECSU-DC, FW-DISREC-DC). ROADS desired condition 3 directs that the location and design of roads not impede wildlife and fish movement which would help address habitat connectivity and NMMJM movement and population expansion through riparian corridors.

Plan guidelines and standards that are in place to mitigate these impacts are as follows:

FW-FAC-G 4 Facilities should use native plants in the design of landscape features.

FW-ROADS-DC 3 Roads do not adversely affect watercourses or sensitive riparian areas.

FW-ROADS-DC 5 Use of NFS roads does not hinder wildlife movement or interrupt critical life-cycle needs (e.g., calving, nesting, and mating).

FW-ROADS-G 2 Bridges and transportation infrastructure found to serve as important habitat for at-risk wildlife should not be demolished unless demolition is necessary for safety along the travel route.

FW-ROADS-G 3 New forest roads and other infrastructure (e.g., recreation facilities, airstrips, etc.) should be designed and constructed to limit the delivery of sediment and pollutants to waterbodies.

FW-ROADS-G 4 When a practical alternative does not exist, the footprint of new roads constructed in the riparian management zone should be as small as practical and the design should include mitigations to minimize or eliminate resource damage to ecological resources. The number of designated stream crossings and the footprint of new roads constructed should be limited to as few as practical to avoid impacts to these features.

FW-ROADS-G 8 Temporary roads (e.g., that support ecosystem restoration activities, fuels management, or other short-term projects) should be closed and rehabilitated (restored to more natural vegetative conditions) upon project completion to protect watershed condition, minimize wildlife disturbance, and prevent illegal motorized use.

FW-ROADS-G 10 If at-risk species are present and will be impacted by road construction or maintenance activities, work should be conducted to avoid or minimize noise and habitat disturbance and outside of critical life-cycle periods (e.g., breeding or nesting for birds) or when animals may not be present (e.g., during migration).

FW-RWE-G 6 The use of motorized equipment should be avoided in the RMZ except when there is a designated stream crossing or when short-term uses are required to improve resource conditions and maintain infrastructure. Use site-specific conditions to delineate a subset within an RMZ where equipment should be excluded around perennial and intermittent streams. Motorized equipment working within the RMZ should be completely clean of petroleum-based fluid residue or use eco-friendly, biodegradable, and

nontoxic hydraulic fluids. Lubricants and fuels should be sealed such that inundation by water should not result in leaks.

While it is unlikely that equipment would be kept or operated within NMMJM habitat or upstream of it, FW-ROADS-G 3, and FW-RWE-G 6 have the potential to help prevent pollutions such as oil, gas, or salt entering riparian habitat. Recreation activities can damage vegetation or increase sediment movement into streams form high use areas. These impacts can be mitigated or avoided by following these guidelines:

FW-DEVREC-G 4 Recreation facilities and improvements should be designed to prevent human and wildlife conflicts. For example, use animal-resistant trash cans and cap or screen pipes on gates, vault toilet vents, interpretive sign bases, and reroute multi-use trails to avoid seeps and springs used by wildlife.

FW-DEVREC-G 6 Managing recreational trends and uses (e.g., drones, satellite dishes, or slack-lining) at developed recreation sites should be considered on a case-by-case basis for protection of public safety, other resources, and quality recreation opportunities.

FW-DISREC-G 1 Trails should be sustainably designed, constructed, rerouted, or maintained using current best practices.

FW-DISREC-G 2 NFS trails should not be used for management activities that negatively impact trail conditions or the user experience unless alternatives entail greater resource damage. Adverse impacts to system trails should be mitigated upon project completion.

FW-DISREC-G 3 All trails (motorized and non-motorized) that adversely impact cultural resources or at-risk species should be mitigated or closed, or alternative travel routes should be developed. New trails should avoid the riparian management zone and have limited stream crossings.

FW-DISREC-G 4 Designated access points to natural waters should be developed within vulnerable recreation areas to protect riparian areas from widespread erosion, trampling, and the introduction of undesirable species.

FW-DISREC-G 5 When closing or mitigating adverse effects of dispersed recreation areas, native vegetation and natural materials should be used.

FW-DISREC-G 6 Dispersed camping sites should be closed, rehabilitated, or otherwise mitigated when:

a) site conditions are no longer consistent with the area's scenic integrity objective,

b) there are persistent user conflicts, or

c) unacceptable environmental damage is occurring (e.g., large areas of denuded vegetation, eroded streambanks, piles of campfire ash, or human waste impacting natural water features).

Analysis of Effects:

This program area, primarily through the presence and maintenance of roads, recreation and motorized trails, can damage soil and vegetation within riparian, floodplain, and adjacent areas that could serve as suitable or restorable NMMJM habitat. Consideration of methods that would discourage dispersed camping near cultural sites, sensitive habitat for at-risk species, interpretive sites, and water resources. It could also improve some riparian areas where NMMJM may be present by removing degrading factors like roads, although there would be the potential for long term and short term impacts from restoration activities. While standards and guidelines could limit road related impacts, not all negative impacts would

be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* NMMJM and its habitat.

Effects of Wildlife, Fish, and Plants

There are three relevant desired conditions that guide management and activities here (FW-TERRASH-DC). Desired condition 2 directs that management and activities provide for habitat configuration and availability to allow for adjustments in movements in response to climate and to provide for genetic diversity, especially important for this disjunct species. The following objectives, desired conditions, standards and guides lines direct management and activities to maintain and support recovery of the NMMJM, including providing for habitat connectivity:

FW-TERRASH-O 1 Maintain, improve, or install at least one water feature per year to improve water availability for wildlife or livestock where natural water sources are limited. These water features can serve dual purposes for both wildlife and livestock and can be done in conjunction with objective for water features in range section.

FW-TERRASH-O 2 Restore or enhance at least 50,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan. This may be done in conjunction with objectives for treatments in the vegetation section.

FW-RWE-DC 2 Riparian and wetland ecosystems have highly productive soils that maintain vegetative cover sufficient to catch sediment, dissipate energy, prevent erosion, stabilize stream banks and shorelines, provide aquatic and terrestrial wildlife habitat, and promote floodplain development. Low departure (0 to 33 percent similarity, LANDFIRE departure formula) from site potential expressed for basal vegetation or bare ground for given TEUI units (Miller et al. 1993), area-weighted for all TEUI units within an analysis area.

a) Long-term impacts to soils (e.g., soil erosion, soil compaction, soil displacement, puddling, and severely burned soils) are rare or non-existent on all riparian area and wetland ecosystems.

b) Moist soil conditions (e.g., thick litter layers, wet areas, coarse woody debris, and decaying debris) are maintained and well-distributed, within the capacity of the vegetation community for at-risk species.

c) Riparian areas should retain a value of more than 30 pieces coarse woody debris per mile (more than 18 per kilometer), diameter larger than 12 inches (larger than 30 centimeters), length over 35 feet (over 10 meters) based on what is considered proper functioning condition.

d) Coarse woody debris provides habitat and is being adequately recruited, to provide a reliable source of replacement.

e) Riparian forest vegetation provides basic life-cycle needs (e.g., nesting, foraging) for riparian-dependent wildlife species (e.g., Neotropical migrant birds, at-risk species).

f) Nectar sources (e.g., buttercup, monkey flower, mountain bluebell, and field mint) are available for at-risk species.

FW-TERRASH-G 3 Activities negatively impacting wildlife reproduction or other vital functions should be minimized (e.g., closures during elk calving), except if management activities are implemented to control wildlife populations to protect the overall health of the habitat or other populations (e.g., NMDGF regulations).

FW-TERRASH-G 4 Management activities that inhibit the reproduction of an individual raptor (disturbing the same nest site) should be avoided in successive years (e.g., via the development of species-specific distance buffers focusing around known nest sites).

FW-INVASIVE-DC 1 Invasive species (including pathogens) are nonexistent or exist at population levels that do not disrupt ecological functioning, affect the sustainability of native species, cause economic harm, or negatively impact human health.

FW-INVASIVE-DC 2 Nonnative species do not conflict with the recovery of native species, negatively influence ecosystem function, or detract from existing multiple uses.

FW-INVASIVE-S 1 Forest management actions must apply best management practices (e.g., Forest Service Handbook, Region 3 Soil and Water Conservation Practices Handbook) to minimize the introduction or spread of invasive species, including: a) Decontamination procedures on vehicles and equipment used in terrestrial and aquatic environments, b) Using weed-free products

FW-INVASIVE-S 2 Projects and authorized activities must be designed to reduce the potential for introducing new species or spreading existing invasive or undesirable nonnative species.

FW-INVASIVE-S 3 Agency and permitted pack-animal users must use pelletized feed.

FW-INVASIVE-S 4 Treatment approaches must use integrated pest management practices to treat noxious and invasive species.

FW-INVASIVE-G 1 Certified, weed-free native seed mixes of local species varieties should be used for revegetation when commercially available. Sterile, nonnative, non-invasive plant material that does not persist long term may be used in limited situations where considered necessary to protect resources and stabilize soils in a timely fashion.

FW-INVASIVE-G 2 Equipment and materials should be stored or staged in areas that are not infested with invasive weeds or other nonnative species.

FW-INVASIVE-G 3 Projects should use locally chipped and shredded woody materials for mulch or, if necessary, use certified weed-free mulch.

FW-INVASIVE-G 4 Management activities should implement procedures to prevent the spread of insects and diseases that impact ecosystem function (e.g., the New Mexico Department of Game and Fish's Aquatic Invasive Species Program and Clean, Drain, and Dry guidelines).

FW-INVASIVE-G 5 As part of project implementation, new populations of invasive species found within the project area should be reported and recorded.

FW-ATRISK-G 1 All authorized activities should be designed and implemented to address threats to at-risk species and their habitats, including, but not limited to:

a) Timing restrictions to encourage reproductive success;

b) Prevention of introduction of non-game invasive, competing, or predatory species (these are species directly and negatively impacting at-risk species populations), and prevention of introduction of nonnative game species to novel locations;

c) Prevention or introduction of pathogens leading to population impacts;

d) Creation or removal of obstructions that may alter natural migration or directly cause mortality to wildlife; and

e) Avoiding or protecting small or isolated populations.

Analysis of Effects:
While standards, design criteria and guidelines could limit introduction of nonnative species certain management activities utilize to provide for habitat configuration and availability to allow for adjustments in movements in response to climate and to provide for genetic diversity, would not mitigate all negative impacts. As such, this program area *may affect and is likely to adversely affect* NMMJM and its habitat.

At-Risk Species

At-risk species include both aquatic and terrestrial species whose persistence is known to be at-risk. Their identification allows us to better address their ecological needs in the plan. At-risk species consist of (1) federally recognized threatened, endangered, proposed, and candidate species, and (2) species of conservation concern). At-risk species are found within all the forest's ERUs. Although some plant, invertebrate, and aquatic species may be found in only one specific ERU, most terrestrial at-risk species use multiple ERUs to complete their basic life-cycle needs. Foraging needs and breeding behaviors of at-risk species often require animals to travel considerable distances spanning multiple ERUs. The following plan components have the potential to reduce or alleviate the potential impacts:

FW-ATRISK-DC 1 Ecological conditions (physical and biotic) contribute to the survival and recovery of federally listed, proposed, and candidate species; preclude the need for listing new species; and allow for the recovery and persistence of species of conservation concern.

FW-ATRISK-DC 2 Intact, functioning, and sufficient habitat for terrestrial and aquatic at-risk species (defined by Desired Conditions for each Vegetation ERU) provide for opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so the species remains viable and persistent on the landscape.

FW-ATRISK-G 1 All authorized activities should be designed and implemented to address threats to at-risk species and their habitats, including, but not limited to:

a) Timing restrictions to encourage reproductive success;
b) Prevention of introduction of non-game invasive, competing, or predatory species (these are species directly and negatively impacting at-risk species populations), and prevention of introduction of nonnative game species to novel locations;
c) Prevention or introduction of pathogens leading to population impacts;
d) Creation or removal of obstructions that may alter natural migration or directly cause mortality to wildlife; and
e) Avoiding or protecting small or isolated populations.

FW-ATRISK-G 2 Project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan.

FW-ATRISK-G 4 Within critical habitat for threatened and endangered species, footprints of ground disturbing fire suppression activities should be as small as possible or located where ground disturbance has previously occurred.

FW-ATRISK-G 7 As part of project implementation, new populations of at-risk, as well as rare and endemic species, found within the project area should be reported and recorded.

FW-ATRISK-G 9 Management of cold water streams with populations of at-risk species should include adequate vegetation cover and width-to-depth ratio to move toward a 7-day average maximum water temperature of less than 17.8 degrees Celsius.

FW-RWE-DC 2 has the potential to help provide the dense, herbaceous vegetation needed by NMMJM.

FW-ATRISK-G 2 by requiring activities comply with listed species recovery plans, would contribute to the recovery of the NMMJM.

Analysis of Effects:
This program area could reduce impacts to NMMJM, although survey for NMMJM and habitat assessments could result in short term impacts from vegetation trampling. Habitat enhancement projects such as riparian fencing to protect habitat could also have short term vegetation and soil impacts in adjacent uplands (e.g., vehicles delivering/laying out materials). Frey and Malaney (2009, p. 38) suggest that maintenance of suitable riparian habitat and long-term viability of jumping mouse populations might only be possible through creation of refugia by complete exclusion of livestock from the riparian zone. Given the vulnerability of the isolated populations (77 documented populations since 2005) more information is needed to conclude that short term disturbance in the riparian zone and adjacent habitat would have minimal impact to NMMJM. While guidelines could limit restoration and other activity impacts and require project or activity mitigations or modifications, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* NMMJM and its habitat.

Effects of Energy, Minerals, and Caves

In January 2018, there were 209 oil and gas leases covering approximately 89,000 acres in the Santa Fe NF, with 50 producing oil and natural gas wells on these leases. All of these leases and wells are within the San Juan Basin portion of the Santa Fe NF were addressed in the Oil and Gas Leasing Environmental Impact Statement (EIS), which included forest plan amendments that established stipulations on new oil and gas leases, completed in 2008, and supplemented in 2012.

Relevant desired condition that guides management and activities include Lease Minerals and Minerals. Minerals desired condition 1 directs that Energy, mineral, and mining activities meet the legal mandates to facilitate the development of minerals in a manner that minimizes adverse impacts to surface and groundwater resources, watershed and forest ecosystem health, wildlife and wildlife habitat scenic character, and other desired conditions applicable to the area:

- FW-LEASEMIN-DC 1 Surface resource impacts resulting from energy mineral development do not have adverse long-term effects on ecosystem health or watershed conditions.
- FW-MINERAL-DC 1 Energy, mineral, and mining activities meet the legal mandates to facilitate the development of minerals in a manner that minimizes adverse impacts to surface and groundwater resources, watershed and forest ecosystem health, wildlife and wildlife habitat, scenic character, and other desired conditions applicable to the area.

A plan component that addresses the impacts to the habitat is FW-MINERAL-S 3; this standard calls for biological inventory and assessments to be conducted to determine use by bats and other wildlife species.

FW-MINERAL-S 11; this standard calls for pre-closure inspections for cave dependent species prior to closing underground mine features. Closures must be designed and implemented to address the needs of resident or historically occurring wildlife within constraints of meeting public safety.

Analysis of Effects:
This program area has the potential through land or facility development or activities to impact NMMJM, often through disturbance and loss/fragmentation of habitat. Effects from the activities of this program are similar to the effects of roads. Access roads and the accompanying vehicle traffic and use of heavy equipment are often associated with mineral activities. In addition, surface occupancy causes direct habitat loss and the addition of human occupation increases the chances for harassment and lethal encounters.

This program area, primarily through the presence and maintenance of roads, recreation and motorized trails, can damage soil and vegetation within riparian, floodplain, and adjacent areas that could serve as suitable or restorable NMMJM habitat. Consideration of methods that would discourage dispersed camping near cultural sites, sensitive habitat for at-risk species, interpretive sites, and water resources. It could also improve some riparian areas where NMMJM may be present by removing degrading factors like roads, although there would be short term impacts from restoration activities. While standards and guidelines could limit road related impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* NMMJM and its habitat.

Effects of Management Areas, Designated Areas, and Geographic Areas

Management Areas

Oil and Gas Leasing Management Area

Provides stipulations to protect resources from actions associated with oil and gas leasing in the portion of the forest where there is the potential for these activities. These stipulations are used to provide agency recommendations to the BLM for issuing new leases on NFS lands. Stipulations include “no surface occupancy,” “controlled surface use,” and “timing limitations” to protect wildlife and surface resources. Conditions of approval and mitigation measures are developed and applied during the second-level NEPA site-specific analysis conducted for individual leases:

MA-OGLEASE-DC 1 Oil and gas activities meet the legal mandates to facilitate the development of minerals in a manner that minimizes adverse impacts to surface and groundwater resources, watershed and forest ecosystem health, wildlife and wildlife habitat, scenic character, and other desired conditions applicable to the area.

MA-OGLEASE-S 1 The following timing limitations apply to drilling operations and construction activities. These do not apply to daily operation and maintenance of producing wells… f). To protect and limit disturbances from drilling activities to at-risk species and other critical wildlife habitat areas, timing restrictions outlined in current and future Federal recovery plans or forest-defined protected activity centers must be followed.

MA-OGLEASE-G 2 To avoid adverse impacts to riparian and wetland resources, access roads and pipelines should not be located in riparian TEUs (or equivalent survey system) or where vegetation data indicates riparian or wetland conditions, unless there are no practical alternative locations and they are located and designed to minimize adverse impacts to riparian or wetland resources.

Recommended Wilderness Management Area

Ecosystem services provided by recommended wilderness management areas include supporting ecosystem services such as nutrient and water cycling; biodiversity; and regulating ecosystem service such as water filtration, air quality protection, and climate change adaptation. Provisioning ecosystem services of food from hunting and foraging also occur here:

MA-RECWILD-S 1 Natural processes shall be maintained within recommended wilderness management areas. a) Fires shall function in their natural ecological role. b) Insect and disease infestations shall be allowed to run their natural course except where they unacceptably threaten wilderness characteristics. c) Nonnative invasive species shall be treated using methods and in a manner consistent with wilderness characteristics, or in order to allow natural processes to occur in a recommended wilderness management area.

MA-RECWILD-G 2 Intervention in natural processes through management activities should only occur where this would move the area toward desired conditions, preserve wilderness characteristics, protect public health and safety within and adjacent to the recommended wilderness management area, or uphold other Federal laws and regulations. a) Unplanned and planned ignitions should be allowed to reduce the risks and consequences of uncharacteristic wildfire to increase apparent naturalness, or to enhance ecosystem function.

Designated Areas

Wilderness Areas

The Santa Fe NF manages four designated wilderness areas, comprising around 291,669 acres, or 18.7 percent of the forest. WSP elements that need increased attention and improvement include natural quality (specifically invasive species), untrammeled quality (specifically from agency management actions), and special provisions (specifically livestock grazing).

DA-WILD-S 3 Nonnative or invasive species must not be introduced into any wilderness area unless for fire recovery purposes, or to maintain the pre-existing sport fish populations in San Gregorio Reservoir.

DA-WILD-G 4 Nonnative, invasive species should be treated using methods and in a manner consistent with wilderness character to allow natural processes to predominate in designated wilderness.

Research Natural Areas

There are two established RNAs on the Santa Fe NF: Monument Canyon and Mesita de los Ladrones. RNAs provide supporting ecosystem services by helping protect biological diversity at genetic species and ecosystem scales, which can also be a regulating ecosystem service.

DA-RNA-S 3 New trail construction must not be permitted.

Wild and Scenic Rivers

The free-flowing character of WSRs is a regulating ecosystem service, providing water to downstream sources and natural river processes (e.g., flood plain connectivity and channel formation). The specific outstandingly remarkable values (ORVs) related with each WSR can have different ecosystem services: Scenic, recreational, historic and cultural ORVs are cultural ecosystem services, while fish, wildlife, and geologic features can contribute supporting ecosystem services.

DA-WSR-G 1 Wild sections of the Rio Chama, Pecos, and East Fork of the Jemez Rivers should:

a) be kept free of impoundments;
b) meet or exceed State standards for water quality;

c) be accessible only by trail; and
d) have shorelines kept in an essentially primitive condition (e.g., essentially free of structures, diversion works, and modifications of the waterway such as rip-rapping and channelization).

Geographic Areas

Are made up of the unique cultural identities, ecology, and types of use specific to different places in the forest. These features may align with ranger districts, county lines, watersheds, or other geographical and socioeconomic boundaries.

Canadas and Nacimiento

The Canadas and Nacimiento Geographic Area, composed of two non-contiguous portions of NFS land totaling over 242,523 acres, lies along the western edge of the Santa Fe NF. The landscape varies greatly from mesas, canyons, and knife ridges in the Canadas, to heavily forested mountains, meadow valleys, and flowing waterways throughout the Nacimiento. Ponderosa pine and piñon-juniper forest restoration and meadow protection is needed throughout this GA. The thinning of dense, small-diameter trees and shrubs in combination with prescribed burning, will support long-range restoration efforts and reinstate natural fire regimes (GA-CANNAC-DC).

Jemez Mesas and Canyons

The 286,938-acre Jemez Mesas and Canyons Geographic Area skirts the Valles Caldera National Preserve to the east and south as well as Jemez and Zia Pueblos to the west. Bandelier National Monument and the community of Los Alamos lie along the southeastern boundary, and the GA also encompasses the 5,000-acre Dome Wilderness. The presence of water in this GA, exemplified by the Rio Cebolla, provides diverse habitats like wetlands, meadows, and forests essential to threatened and endangered species like the New Mexico meadow jumping mouse, Jemez Mountain salamander, and the Mexican spotted owl.

High-use recreation across the Canadas and Nacimiento GA, predominantly overnight camping along waterways and along NFS Road 376, has negatively impacted vegetation and water quality. Compaction of soils from vehicles parked alongside roads, illegal dumping, and noise and air pollution require management of dispersed camping to promote a healthy watershed (GA-JEMMC-DC).

North Jemez Mountains

The 404,168-acre North Jemez Mountains Geographic Area rises from the San Juan Basin on the west to mesas, knife ridges, and remote meadows that drop into the Chama River Canyon Wilderness on the east, and borders the Valles Caldera National Preserve and San Pedro Parks Wilderness on the south. Borrego Mesa on the northwest corner of the eastern side of the Santa Fe NF is included in the North Jemez Mountains GA because the terrain is similar, and local communities predominantly use these parts of the forest in the same way.

Thinning of dense, small-diameter vegetation and prescribed burning will support long-range restoration efforts and reinstate natural fire regimes. Restoration will result in decreased woody encroachment of meadows, restored and preserved grasslands, improved watershed health, and greater wildlife diversity (GA-NJEMM-DC).

West Sangres and Caja

The West Sangres and Caja Geographic Area starts south of Borrego Mesa and stretches over 203,903 acres along the western slope of the Sangre de Cristo Mountain Range to Grasshopper Canyon south of Shaggy Peak. Small streams throughout the West Sangres and Caja GA support dense forests that rise from piñon-juniper woodlands to spruce-fir alpine peaks.

Recreation has resulted in increased pressure on developed campsites and trails overly dense forest in this GA increase the risk of uncharacteristic, stand-replacing wildfires in the extensive wildland-urban interface along the border of the city of Santa Fe and the Santa Fe Municipal watershed, requiring forest restoration such as thinning and prescribed burning of dense, small-diameter vegetation (GA-WSANCAJA-DC).

Analysis of Effects:
Guidelines to decrease the footprint of ground disturbing activities can be found in multiple plan components throughout a variety of resources including Riparian Management Zones, At-risk Species, Soils, Forestry, Roads, Special Uses, and Minerals. Common verbiage includes, "footprints of ground-disturbing activities should be as small as possible or located where ground disturbance has previously occurred." Under the proposed action, temporary roads that support ecosystem restoration activities, fuels management, or other short-term projects should be closed, decommissioned, or obliterated (restored to more natural vegetative conditions) upon project completion to protect watershed condition, minimize wildlife disturbance, and prevent illegal motorized use. There are also objectives to mitigate ecological damage at developed recreation sites every three years.

Because NMMJM utilize adjacent upland habitats for dispersal, day nesting, maternal nest, and hibernating recreational activities such as camping, fishing, and off-road vehicle use pose a concern to the jumping mouse because the development of trails, barren areas, and trampling can render habitat unsuitable by reducing or removing dense riparian herbaceous vegetation that is required by the subspecies. NMMJM require adequate herbaceous riparian vegetation to support foraging, breeding, and hibernating individuals. Fragmentation and habitat loss contribute to population isolation. While standards and guidelines could limit related impacts, not all negative impacts would be reduced or eliminated. As such, these program areas *may affect and is likely to adversely affect* NMMJM and its habitat.

Effects on Critical Habitat and Primary Constituent Elements

Effects to occupied, suitable, recoverable or dispersal habitat discussed above would apply to proposed critical habitat for this species. Table 11 shows which program areas may impact specific proposed critical habitat PCEs in either a positive or negative manner.

Table 11. NMMJM proposed critical habitat PCEs potentially impacted by program area

Program Area	Affected PCEs (by number) and Principle Mechanism
Fire and Fuels	1. Prescribed burning of tall, dense riparian vegetation.
Ecosystem/Vegetation Health (Vegetation – Ecological Response Units)	1. Equipment or activity impacts to upland soils with sediment into riparian areas; there is also the potential to reduce risk of severe wildland fire and associated scouring floods.
Sustainable Rangelands and Livestock Grazing	1, 2, 3 and 4. Vegetation trampling and grazing, inhibit recovery to vegetation potential (composition, density, height) in riparian and adjacent upland areas; sufficient space (length of riparian area for travel corridor).
Water Resources, Riparian and Wetland Ecosystems and Soil Management (Riparian Areas)	1 and 3. As above; water quality and quantity plus potential restoration of riparian structure and function.
Infrastructure, Roads and Facilities	1 and 4. Road within floodplains and riparian areas that limit or influence wetted areas.
Energy, Minerals, and Caves	2. Special uses impacting water quantity or quality.
Recreation and Designated and Management Area	1 and 4. Vegetation trampling in riparian/wetland and adjacent areas.

Program Area	Affected PCEs (by number) and Principle Mechanism
Wildlife, Fish, and Rare Plants	1, 2, and 4. Potential for short term trampling impacts from survey and habitat assessments and from habitat enhancement projects.

PCE 1 Riparian communities characterized by emergent herbaceous wetland [vegetation]
All program areas are likely to have some impact on riparian/wetland vegetation within critical habitat given that riparian areas are where most types of forest activities occur. Developed recreation use is especially heavy within the San Antonio Creek recreation area within the critical habitat subunit of this name.

PCE 2 Flowing water, saturated soils, dense vegetation
While special uses for water diversion or groundwater pumping are not known to be impacting flow in critical habitat, there is potential that increased development of private land may create more demand for special uses for water conveyances (e.g., spring developments, pipelines) from NFS to private land. Livestock grazing is likely impacting some areas that may be suitable or restorable NMMJM habitat.

PCE 3 Sufficient space
Not all segments of critical habitat provide a minimum of 5.6 miles in length of suitable habitat but may contain restorable habitat. Objectives to enhance or restore riparian areas may or may not occur within critical habitat. Where they do, there would be short term negative impacts from equipment or people such as vegetation trampling and streambank disturbance.

PCE 4 Floodplain and upland areas

While standards and guidelines limit impacts in floodplains and upland areas, not all acreage within approximately 100 m (330 ft. outward of the water's bankfull edge) within critical habitat and not all impacting activities (e.g., grazing, roads, developed campsites) are precluded here.

Overall, essentially all program areas are likely to have some negative impacts to NMMJM primary constituent elements of critical habitat. However, it is important to note that LMP implementation would not necessarily have these impacts across all critical habitat for the NMMJM on the Santa Fe NF.

Cumulative Effects and Climate Change

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area of impacts for a listed species. State activities to date have included survey for presence or absence of NMMJM. NMDGF fish stocking program draws people to some NMMJM sites and proposed critical habitat. During hunting and fishing seasons NMMJM habitat may be impacted. This impact can include: trampling of forage/cover vegetation, noise, harassment of individual mice or crushing of nests. Within the Jemez Mountains Conservation Area, recreation in San Antonio Creek and Rio Cebolla streams systems established campgrounds and dispersed camping has the potential to damage habitat. Road maintenance adjacent to Lower Rio Cebolla, FR 379 could reduce habitat availability and could cause sedimentation to reach the stream system. Private land activities include some business and home sites with associated structures as well livestock grazing with facilities. Private land grazing is typically heavy and some is year round.

The implications of climate change and variability for NMMJM with greater extremes of temperature and moisture could reduce water quantity and habitat quantity over time. With potential for higher intensity of

storms, there could also be the possibility that flood impacts along streams may occur at more frequent intervals and at greater intensities resulting in continued threats to NMMJM and habitat.

Summary and Determination Effects

Summary

Restoration by wildfire and prescribed fire

- Fire may reduce encroachment of woody species where the densities of woody species is outside the range of natural variability for riparian ERUs in the Santa Fe NF, encouraging the return of natural fire regimes and restoring native ground cover.

- Fire may cause adverse effects to Riparian Management Zones if fire severities cause super-heating of the soil. High heat not only removes groundcover, but can cause soil hydrophobicity by which water is repelled from soil pores (DeBano et al. 1976). In large areas of hydrophobicity, excessive runoff is generated because infiltration is significantly reduced (DeBano 1971). Excessive runoff can result in flashier hydrographs (Moody and Martin 2001) as well as erosion and sedimentation (Certini 2005), both of which adversely affect water quality and aquatic habitat. In some cases, high severity fire in riparian areas could cause heating of the soil to temperatures high enough to kill both existing vegetation and the native seeds and volatize available nutrients in the soil, in these cases natural recovery potential could be retarded and the riparian areas left more vulnerable to invasion by nonnative species, which thrive after disturbances and are well adapted to nutrient poor soils.

Vegetation Management

Mechanical harvest and thinning vegetation treatments use heavy equipment such as forwarders, skid-steers, and feller-bunchers. Potential effects, both positive and negative, from mechanical harvest and thinning are listed below.

- Removing and thinning woody species encroachment will help restore desired vegetation species composition and structure in Riparian Management Zones, returning riparian areas toward desired conditions and contributing to more natural hydrologic cycles and functions.

- Heavy equipment use in sensitive riparian areas can compact and rut the soil. Rutted soil is likely to channelize water, making it more susceptible to erosion and entrainment (Elliot et al. 2010); compacted soils have reduced infiltration, resist revegetation, and have increased erosion. The increase in erosion from channelized runoff and compacted surfaces will lead to degraded riparian hydrologic function and increase sedimentation into streams.

- Removing and thinning encroaching woody species from Riparian Management Zones, particularly from HERB and CWG ERUs may increase hydrologic connectivity between riparian areas and streams by increasing shallow subsurface flow available to replenish streams (Huxman et al 2005, Scott et al 2006).

Livestock grazing

- Herbivory reduces or eliminates the tall, herbaceous vegetation stature and density used by the jumping mouse for food and cover (Belsky et al. 1999, entire; Fleischner 1994, entire; Frey 2005a, entire; Frey and Malaney 2009);
- Grazing results in the loss of vegetative cover and depletion of food resources

- Grazing within riparian areas can also result in soil compaction, herbaceous removal, physical damage to plants, and changes in fluvial processes (Trimble and Mendel 1995)
- Elk, cattle, and feral horse concentration in jumping mouse habitat affects the stream channel condition needed to support riparian vegetation and wet soils:
    - Stream bank erosion (streambank alteration and decrease in riparian plant vigor);
    - Stream channel incision or aggradation;
    - Soil compaction.

Restoration Activities

Stream channel and riparian restoration actions include a suite of possible activities that all should have the beneficial effect of rehabilitated geomorphic and biological processes, which would help to restore stream and riparian ecosystem services. Restoration actions will ensure that streams and riparian areas are properly functioning, which provide clean water, regulated water temperature, water storage, sediment storage, nutrient cycling and good habitat (Gregory et al. 1991).

- Heavy equipment use for any restoration action including road decommissioning will increase ground disturbance and may increase erosion causing sedimentation through the riparian area into the adjacent waterway. Sediment and turbidity adversely affect water quality, aquatic habitat, and flood capacity by making water more difficult to clean, decreasing the oxygen supply to fish and amphibians, decreasing habitat diversity and availability, as well as decreasing channel volume (Henley et al. 2000; Postel and Thompson 2005).

Road Decommissioning

Road decommissioning is a common restoration practice which involves using heavy equipment to treat the road prism to reduce erosion and hydrologic impact. Levels of treatment range widely, but generally requires decompacting the road and may involve removing the road prism and reshaping the area to match natural hillslope contours.

- Road decommissioning should benefit surface water resources and Riparian Management Zones through restored hillslope drainage patterns, increased infiltration, increasing water storage and retention, restored hydrographs, decreased channel aggradation, and improved water quality.

- Reducing road system mileages may limit motorized use impacts in RMZ including the spread of invasive plants and increases in erosion. Ultimately, these should result in a water supply that is less expensive to clean to standard, increased baseflows during the dry periods of the year, and improved fisheries.

- Heavy equipment is often used to accomplish restoration, thereby disturbing the ground within or adjacent to flowing water. Ground disturbance dislodges soil, making it easier to erode and entrain, thereby, introducing sediment and turbidity to the waterbody. Further, restoration activities may temporarily alter stream shade by removing vegetation during work.

- Invasive species (noxious weed) removal and treatment includes both hand (pulling weeds) and chemical treatment (applying herbicides).

- As one of the major limiting factors in properly functioning condition (PFC) of Riparian Management Zones, removal of invasive species should help promote recovery of vegetation species and composition and PFC of Riparian Management Zones.

- Use of chemical application can adversely affect water quality when sediment or chemicals are delivered to a water body through the riparian area. Longer than predicted residence times of herbicide in soils are not uncommon, and as the herbicide remains in the soil it can inhibit the recovery of native vegetation.

Dispersed recreation

Dispersed recreation areas can be detrimental to riparian areas where human use concentrates in riparian areas adjacent to streams and wetland features. Detrimental effects intensify if sites are accessed by motorized vehicle.

- Concentrated human use can destabilize soils by foot and vehicle traffic damaging aquatic habitat and water quality through loss of vegetation and increased sedimentation. Water quality can be further degraded by human waste, fuel (for stoves, ATVs, etc.), and other contaminants that are introduced to waterbodies. Restoring dispersed sites can have the long term positive impacts on vegetation and water quality and have short-term negative impacts.

- Dispersed sites that are merely closed and not actively rehabilitated will not experience the short-term impacts from heavy equipment use in riparian areas but also will not likely improve or recover completely on their own. Sites will remain compacted from years of vehicle traffic; the compaction will inhibit revegetation leaving exposed soils and vulnerabilities to invasive plant encroachment. The compacted bare ground will prevent infiltration of precipitation, which will cause continued runoff and erosion degrading water quality.

Determination of Effects

Habitat modification or degradation can impair essential behavioral patterns such as breeding, feeding, or sheltering. Indirect causes of mortality can include changes in quality and quantity of food, nest site availability, predation, parasitism, disease, increased competition, and social interactions (Sullivan 1995). Livestock grazing, even with low numbers, destroys sensitive streamside habitat through loss of vegetation, alteration of the vegetative community by selective grazing of certain species, soil compaction, and general destruction from trampling. Reduction in forage in grazed habitat generally reduces food availability during the winter. Reduction of suitable habitat due to grazing also puts individual mice more at risk of succumbing to predation due to the loss of vegetative cover.

Off-road vehicle recreation, camping, fire and subsequent erosion, flooding, water diversion for agricultural and urban use, ongoing drought, and climate change all contribute to further degradation of the mouse's habitat.

Mortality from fire can be directly caused by burns, heat stress, asphyxiation, physiological stress, trampling by other animals, or predation while fleeing fire (Sullivan 1995). Overall the LMP direction is to maintain or restore desired conditions for ERUs, watersheds, and riparian areas. Standards and guidelines would require measures to limit the extent, level, and duration of potential short term effects and preclude negative long term effects in the case where long term riparian degradation cannot be avoided.

However, the LMP implementation does not provide for mitigation of all potential effects to a level that can be equated to or considered insignificant and/or discountable. Therefore, it is determined that LMP implementation ***may affect and is likely to adversely affect*** the NMMJM and ***it may affect and is likely to adversely affect*** critical habitat for this species.

Mexican Spotted Owl (*Strix occidentalis lucida*)

- Endangered Species Act Status: Threatened, March 16, 1993
- Recovery Plan, First Revision: September 5, 2012
- Critical Habitat: August 31, 2004
- District Occurrence: Coyote, Jemez, Española, and Pecos-Las Vegas Ranger Districts.
- Determination of Effects (species): ***May Affect, Likely to Adversely Affect***
- Determination Effects (critical habitat): ***May Affect, Likely to Adversely Affect***

For brevity, the Mexican spotted owl is referred to as MSO throughout the document. MSO protected activity centers are referred to as PACs. The first revised MSO Recovery Plan (USFWS 2012) is referred to as simply the MSO Plan.

Status of Species and Habitat

Legal Status and Description

In 1993 the U.S. Fish and Wildlife Service (USFWS) listed the Mexican spotted owl (*Strix occidentalis lucida*) as threatened under the Endangered Species Act (ESA). Critical habitat for the Mexican spotted owl was designated in 2004, comprising approximately 3.5 million hectares (ha) (8.6 million acres [ac]) on Federal lands in Arizona, Colorado, New Mexico, and Utah (69 FR 53182). Within the critical habitat boundaries, critical habitat includes Protected Activity Centers (PACs), Recovery habitat, and other forest and woodland types, such as ponderosa pine forest, spruce-fir forest, and pinyon-juniper woodlands defined in the Mexican Spotted Owl Recovery Plan, revised in 2012.

The Santa Fe NF falls within the Southern Rocky Mountain Ecological Management Unit (SRM EMU). The SRM EMU falls partly within the Southern Rocky Mountains Physiographic Province and partly within the Colorado Plateau Ecoregion (Bailey 1980). Mountain ranges characterize the EMU. Vegetation varies from grasslands at low elevations through pinyon-juniper woodlands, interior shrublands, ponderosa pine, mixed-conifer and spruce-fir forests, to alpine tundra on the highest peaks (Daubenmire 1943).Major ranges include the Sangre de Cristo and Jemez Mountains. Numerous high peaks with alpine tundra are present in the Sangre de Christos north of Santa Fe (Williams 1986). The Jemez Mountains are an extensive volcanic caldera with associated volcanic flows and tuff deposits.

Critical Habitat and Primary Constituent Elements

Critical habitat for MSO was designated in 2004. Critical habitat unit Southern Rocky Mountain Ecological Management Unit encompassing just 80,487 hectares (198,888 acres) of designated critical habitat in the Santa Fe NF. Four Critical Habitat (CH) units occur entirely or partially within the boundaries of the Santa Fe NF: SRM-NM-1, SRM-NM-4, SRM-NM-5a, and SRM-NM-5b. Units SRM-NM-1 and 4 occur on the Cuba and Jemez RD within the Jemez Mountains of the Santa Fe NF. Units SRM-NM-5a and 5b occur within the Pecos-Las Vegas RD on the eastern side of the Forest. Critical

habitat units on the Santa Fe NF contain about 41,383 ac of protected activity centers and varying degrees of recovery habitat within mixed conifer forests.

Critical habitat primary constituent elements are the physical or biological features essential to the conservation of the species that may require special management considerations or protection. The Mexican spotted owl requires a variety of mixed conifer habitats, proximity to riparian areas, standing large snags for roosting and nesting, or cavities in vertical canyon walls. Timber harvest, prescribed burning, and other management activities are designed following the Mexican Spotted Owl Recovery Plan 2012 along with consultation with the USFWS. These management activities can still have disturbance affects to the Mexican spotted owl and its habitat. Primary constituent elements for MSO occur within dry mixed conifer, wet mixed conifer, spruce-fir, the pine-oak portion of ponderosa pine forest

Primary constituent elements for MSO nesting, roosting, foraging, and dispersal follow (vegetation descriptions are per the 2012 MSO Plan).

1. Primary constituent elements related to forest structure:
    a. A range of tree species, including mixed conifer, pine-oak, and riparian forest types, composed of different tree sizes reflecting different ages of trees, 30% to 45% of which are large trees with a trunk diameter of 12” or more when measured at 4.5’ from the ground;
    b. A shade canopy created by the tree branches covering 40% or more of the ground; and
    c. Large dead trees (snags) with a trunk diameter of at least 12” when measured 4.5’ from the ground.
2. Primary constituent elements related to maintenance of adequate prey species:
    a. High volumes of fallen trees and other woody debris;
    b. A wide range of tree and plant species, including hardwoods; and
    c. Adequate levels of residual plant cover to maintain fruits, seeds, and allow plant regeneration.
3. Primary constituent elements related to canyon habitat include one or more of the following:
    a. Presence of water (often providing cooler and often higher humidity than the surrounding areas);
    b. Clumps or stringers of mixed-conifer, pine-oak, piñon-juniper, and/or riparian vegetation;
    c. Canyon wall containing crevices, ledges, or caves; and
    d. High percent of ground litter and woody debris.

Life History and Distribution

Life history, distribution, status of this species range-wide along with listing factors are found in documents located on the USFWS website https://www.fws.gov/southwest/es/MSO_Main.html (accessed 2019). An account of the taxonomy, biology, and reproductive characteristics of the MSO is found in the Final Rule listing the MSO as a threatened species (USFWS 1993) and the MSO Plan, first revision (USFWS 2012).

Distribution, Abundance, and Trend

The Mexican spotted owl is federally listed as Threatened. It is found from parts of central Colorado and Utah, south through Arizona, New Mexico, and west Texas, then south through northwestern Mexico to the State of Michoacán. It has the largest geographic range of the three spotted owl subspecies. Its range extends from the southern Rocky Mountains in Colorado and the Colorado Plateau in southern Utah, southward through Arizona and New Mexico and, discontinuously, through the Sierra Madre Occidental and Oriental to the mountains at the south end of the Mexican Plateau (USDI, USFWS, 1993). Global

range-wide abundance is 1,000-3,000 individuals. Though 16 years has passed since the first recovery plan, total population size is not reliably known (USFWS, 2012).

MSO are residents in the mountains of New Mexico, being most regular in the south. They can be found in the San Juan, Jemez, Sangre de Cristo, Mount Taylor, Sandia, Manzano, San Francisco, Tularosa, Mogollon, San Mateo, Pinos Altos, Black, White, Sacramento, Guadalupe and Animas mountains (Hubbard, 1978). In 2016 biologists identified 61 PACs within the boundaries of the Santa Fe NF. There are 45 occupied PACs (PACs by Ranger Districts: Coyote 1, Cuba 5, Espanola 5, Jemez 30, and Pecos 20), 13 occupied PACs awaiting USFS consultation and approval, and 3 PACs proposed for decommission as a result of wildfires. The MSO is threatened by damage and modification of habitat caused by timber harvest and fires. Fuel accumulation and forests overstocked with trees place spotted owl habitat at risk to stand-replacing fires. Lack of small-scale, low intensity ground fires has increased this risk.

Threats

Threats to the owl identified in that management plan include abandoned mine reclamation, commercial timber harvest, wildland fire and fire management, fuelwood harvest, livestock grazing, home-site development, large-scale coal mining, recreation, road building and reconstruction, and other human developments and activities. Recreation activities (often associated with motor vehicles such as ATVs) have contributed noise and disturbance to MSO. Other threats to MSO like West Nile virus, predation, wildland fire, or potential for Barred owls are outside of forest management.

Large Area Size

Timber-harvest practices in the Southwestern Region were cited as the primary factors threatening the continued existence of the owl. Timber is not a major industry in the Santa Fe NF, partly due to fewer large trees of commercial value. Instead, the value many local communities draw from the forest's wood resources is the abundant fuelwood.

Disease or Predation

Great horned owls and other raptors are predators of Mexican spotted owls. Forest management can create transition habitats (i.e., ecotones) favored by great horned owls, thus creating an increased likelihood of contact between the two owl species.

Status of the Species and Habitat in the Action Area

Status of Species within the Action Area

Known on Coyote, Jemez, Española, and Pecos-Las Vegas Ranger Districts. This species is apparently non-migratory and feeds primarily on small mammals. Young owls, however, are known to disperse long distances. A recent record documents the movement of a Mexican spotted owl banded on the Gila NF found dead on the Carson NF (RMRS 2013), which could mean it might have travelled through the Santa Fe NF.

Status of Habitat within the Action Area

The Mexican spotted owl requires a variety of mixed conifer habitats, proximity to riparian areas, standing large snags for roosting and nesting, or cavities in vertical canyon walls. Timber management activities negatively affected habitat before the Mexican spotted owl was listed as threatened in 1995. Timber harvest, prescribed burning, and other management activities are designed following the Mexican Spotted Owl Recovery Plan 2012 along with consultation with the USFWS. These management activities can still have disturbance affects to the Mexican spotted owl and its habitat.

Conservation Measures: Conservation Actions 7 (a)(1)

No specific conservation actions have been implemented for the Mexican Spotted Owl on the Santa Fe; however, a Forest Plan guideline requires that project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan. The proposed action also includes management approaches for at-risk species. These would further help to provide persistence for the mouse throughout its range by promoting collaborative partnerships to aid in recovery and delisting and to consider habitat fragmentation on adjacent lands when planning activities on the Santa Fe. They include the following:

Management Approaches (FW-ATRISK-MA-1 and FW-ATRISK-MA-2)

Effects Analysis for Mexican Spotted Owl

In the individual program areas discussions below, the implication of relevant desired conditions to MSO are noted. Potential impacts of each objective, standard, and guideline to the species and habitat are described. Where applicable, management areas are addressed. A determination of effects is then made for that program area. Subsequent to all program areas, an overall determination of effects for this species and its critical habitat from LMP implementation is provided in the Summary of Effects and Determinations section for MSO.

Over 60 percent of all at-risk species on the Santa Fe NF are impacted by highly departed seral state (Santa Fe NF Plan Final Assessment Report, 2016). Seral state is a complex issue that deals with the ecological succession of vegetation as it progresses toward a climax community. It looks at how vegetative systems age over time and what the average range of age classes of vegetation exist within the system. The vegetation analysis in this EIS considers seral state departure for each ERU on the Santa Fe NF. The Mexican spotted owl utilize 11 of the 12 upland ERUs as habitat: CPGB, JUG, MCD, MCW, MSG, PJO, PPF, PJG, SAGE, and SFF.

Table 12. Seral state departure within ERUs (Santa Fe NF Assessment 2016)

System	ERU Code	ERU Name	Departure	Departure Index
Grassland	CPGB	Colorado Plateau/Great Basin	High	93
Grassland	MSG	Montane/Subalpine Grassland	Moderate	60
Shrubland	ALP	Alpine Tundra	Low	---
Shrubland	SAGE	Sagebrush Shrubland	Moderate	41
Woodland	JUG	Juniper Grass	Moderate	45
Woodland	PJG	Pinyon Juniper Grass	Moderate	45
Woodland	PJS	Pinyon Juniper Sagebrush	Moderate	46
Woodland	PJO	Pinyon Juniper Woodland	Low	28
Forest	MCD	Mixed Conifer-Frequent Fire	High	74
Forest	MCW	Mixed Conifer with Aspen	Moderate	47
Forest	PPF	Ponderosa Pine Forest	High	97
Forest	SFF	Spruce-Fir Forest	Moderate	54

Effects of Vegetation Management and Fire and Fuels

Management Common to All Vegetation Types

There are 33 relevant desired conditions that guide management and activities here (see Table 7).

Desired conditions in ALL FW-VEG-DC, and FW-WUI-DC 2 and 3 and FW-FIRE-DC 2 and 3 directs management toward activities and conditions where fire is again able to play its historic role in maintaining fire adapted ecosystems; this would reduce the threat of stand-replacing or uncharacteristic wildfire to MSO and habitat. Desired conditions in ALL FW-MCW-DC, FW-MCD-DC, FW-PPF-DC represent a restored the fire frequency interval in five specific PNVTs which can provide MSO and its habitat.

Desired conditions within the proposed action explicitly defines the percentage of seral states in each forested ERU (i.e., early, mid-, and late-). They also provide guidance on tree size class, vegetation structure, fire return interval, dominant understory vegetative species types, as well as specific ecological conditions indicative of a healthy ecosystem. The proposed action sets a maximum objective within MCD and PPF of 280,000 to 350,000 acres of restoration work to be completed respectively, over a 10-year period. The desired conditions in the proposed action calls for 72 percent of MCD to be open canopy. The objectives, standards, and guidelines in the proposed action would reduce this risk of catastrophic fire by moving toward desired conditions which call for 86 percent of PPF to be open canopy. This would improve seral state and reduce the likelihood that uncharacteristic fire would negatively impact on MSO.

FW-VEG-O 1 Over a 10-year period, complete at least the following treatments to move vegetation resources toward desired conditions:

Vegetation ERU	Mechanical Treatment (acres)	Prescribed Fire and Naturally Ignited Wildfire (acres)
Mixed Conifer with Frequent Fire (MCD)	10,000–80,000	50,000–200,000
Ponderosa Pine (PPF)	15,000–100,000	150,000–250,000

FW-VEG-O 2 Over a 10-year period, complete 2,500 to 50,000 acres of combined vegetation treatments in highly departed non-forested ERUs to move vegetation toward desired conditions (i.e., restoration). Treatments may include mechanical treatments, prescribed fire or naturally ignited wildfires, seeding, or other techniques still to be determined by best available science depending on the specific ERU. Highly departed non-forested ERUs are juniper grass (JUG), piñon juniper grass (PJG), Colorado Plateau Great Basin grassland (CPGB), sagebrush shrubland (SAGE), and montane subalpine grassland (MSG).

FW-VEG-G 1 Management activities should favor the retention of species that naturally occurred in those ecosystems. Native species should be present in the relative proportions characteristic of those ecosystems.

FW-TERRASH-DC 1 Terrestrial ecosystems are composed of appropriate (native) assemblages of sustainable populations of plant and animal species that are supported by healthy ecosystems.

a) A diversity of habitat components, including biotic and abiotic features, are available at the appropriate spatial, temporal, compositional, and structural levels (as defined by Desired Conditions for each Vegetation ERU) to provide adequate opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so that forest species remain viable and persistent on the landscape.

b) Undesired nonnative and invasive terrestrial species, as well as introduced pathogens, are rare or absent (per Desired Condition 1 in Wildlife: Nonnative and Invasive Species).

c) Terrestrial habitats allow for the maintenance and promotion of interspecific relationships at all trophic levels (e.g., producer-consumer and predator-prey relationships) across multiple scales, consistent with existing landforms and topography.

FW-TERRASH-DC 2 Habitat configuration, connectivity, and availability allow wildlife populations to adjust their movements in response to major disturbances (e.g., climate change or uncharacteristic fire) and promote genetic flow between wildlife populations.

FW-TERRASH-O 1 Maintain, improve, or install at least one water feature per year to improve water availability for wildlife or livestock where natural water sources are limited. These water features can serve dual purposes for both wildlife and livestock and can be done in conjunction with objective for water features in range section.

FW-TERRASH-O 2 Restore or enhance at least 50,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan. This may be done in conjunction with objectives for treatments in the vegetation section.

Treatments within the upland ERUs will benefit MSO in the long-term, but will have short-term effects to foraging habitat, change in stand structure which may impact nesting, noise during treatment operations would cause disturbances to any individuals in the area. Site specific treatments will be designed to meet the objectives and measures in the Recovery Plan. The use of wildland fire provides for desired ERU conditions including maintain species needed by wildlife. After a landscape-scale fire, it also provides reestablishment of native plants needed by wildlife and their pray. Most, but not all, firewood cutting occurs in the fall after the MSO breeding season; however, in general, desirable firewood/fuelwood or firewood species utilized by MSO are Douglas fir and Gambel oak-which could potentially impact MSO habitat to some extent.

FW-FORESTRY-S 1 Regulated timber harvest (tree harvest for the purposes of timber production) must occur only on lands classified as suitable for timber production (16 U.S.C. 1604).

a) On lands suitable for timber production, timber harvest intended to create openings for tree regeneration must only be used when there is reasonable assurance of restocking within 5 years after final regeneration harvest.

b) Timber harvest would occur only where soil, slope, or watershed conditions would not be irreversibly damaged.

c) Timber will be harvested only where protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water.

d) Timber harvest will be carried out consistent with the protection of soil, watershed, fish, wildlife, traditional use resources, cultural and historic resources, recreation, and aesthetic resources.

e) Timber will be harvested only where the harvesting system is not selected primarily because it will give the greatest dollar return or unit output of timber.

FW-FORESTRY-S 2 Harvests to meet resource objectives other than timber production (e.g., fuelwood harvest, protection, and habitat enhancement) are permitted on all lands (i.e., suitable and not suitable).

FW-FORESTRY-G 1 On suitable timberlands, regeneration harvest of even-aged stands should have reached or surpassed 95 percent of the culmination of mean annual increment, unless it is needed to:

a) Reduce fire hazard within the wildland-urban interface (WUI),

b) Contribute toward achieving the desired uneven-aged vegetation conditions over the long term, or

c) Treat unsustainable stand conditions resulting from insects, disease, or other damage agents.

Analysis of Effects:
Prescribed fire and mechanical treatments could, over the long term, reduce uncharacteristic wildfire and the associated risk of substantial or complete loss of areas providing MSO PAC and Recovery habitat. . However, activities associated with burning (equipment, personnel, smoke) could also result in short term impacts such as disturbance to nesting MSO, smoke settling into PACs, and temporary loss of herbaceous vegetation needed by their prey. Fires, whether prescribed or naturally ignited, can also destroy snags and downed woody debris (Randall-Parker and Miller 2002), thereby degrading habitat conditions for MSO prey species in the short term. Stand replacing wildfire kills trees used for nesting and roosting which can alter the habitat to such a degree that it is no longer suitable for MSO. They become more vulnerable to predators due to lack of cover, and are less likely to reproduce successfully if nesting and prey habitat have been degraded.

The impact of fire suppression activities on habitat quality can, in some cases, exceed that of the fire itself (Backer et al. 2004). Backfires may char MSO habitat. Low-flying aircraft dropping water or retardant may result in disturbance or injury. Bulldozer lines compact the soil and may cause erosion, which in turn can affect the quality of MSO nesting and foraging habitat. Dozer lines can easily become avenues for recreational vehicle access, and hand lines can result in hiker and mountain bike disturbance to nesting owls. Invasive or noxious weed species transported on the wheels of heavy equipment can affect the foraging success and abundance of prey species.

While guidelines could help limit these impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* MSO and its habitat.

Effects of Watershed and Soil Management

There are four relevant desired conditions that guide management and activities here FW-RWE-DC. Desired conditions 1 and 2 would provide for structurally diverse, dense, and large tree conditions to support riparian dependent species. Desired conditions 3 and 4would protect against the risk of diminished water that supports MSO recovery habitat. Desired conditions, guidelines and standards would help protect soil, and hence vegetation density, cover, and height (seedheads) conditions in riparian recovery habitat needed by MSO prey:

FW-RWE-O 1 Riparian ecosystems move toward desired conditions (less than a 33 percent departure from DC) for vegetation functional diversity, vegetation seral state, riparian corridor connectivity, and flood regime (frequency, duration, and magnitude) by implementing 15 miles of stream every 10 years.

FW-RWE-G 2 Within RMZs, management activities (e.g., recreation, permitted uses, structural developments such as livestock water gaps, pipelines, or other infrastructure) should occur at levels or scales that move toward desired conditions for water, soils, aquatic species habitat, and vegetation within the sub-watershed in which the management activity is taking place. Activities and facilities with a small footprint (e.g., access points, intermittent livestock crossing locations, water gaps, or other infrastructure) may be necessary to manage larger scale impacts within the RMZ, recognizing there may be trade-offs between activities and resources.

FW-RWE-G 5 Downed woody material in stream channels should be retained except where safety is a concern (e.g., sections of streams where rafting is likely).

FW-RWE-O 1 has the potential to improve overall soil and vegetation conditions within selected watersheds through restoration projects (e.g., increase herbaceous ground cover with thinning, recontour incised channels, plantings of willows and grasses). However, there would also be the potential for short term implementation impacts (e.g., disturbance where these restoration efforts occur within MSO habitat). Where it occurs within MSO recovery habitat, objective 6 has the potential to improve MSO habitat in riparian areas but it would also potentially have short term implementation impacts to MSO (e.g., disturbance to MSO and soil or vegetation compaction to prey habitat).

FW-RWE-G 6 The use of motorized equipment should be avoided in the RMZ except when there is a designated stream crossing or when short-term uses are required to improve resource conditions and maintain infrastructure. Use site-specific conditions to delineate a subset within an RMZ where equipment should be excluded around perennial and intermittent streams. Motorized equipment working within the RMZ should be completely clean of petroleum-based fluid residue or use eco-friendly, biodegradable, and nontoxic hydraulic fluids. Lubricants and fuels should be sealed such that inundation by water should not result in leaks.

FW-RWE-G 8 Connectivity within FSR should be restored or maintained by protecting ecological functions, tree density and growth, and native understory, to reduce the risk of predation and nest parasitism, and to provide habitat for at-risk and other wildlife species.

FW-RWE-G 9 In FSR types, fuelwood cutting or wood removal should be managed to protect understory species, maintain tree density (including wildlife cover and stream shading), promote large woody material recruitment, and avoid channel downcutting and accelerated erosion.

FW-RWE-G 10 In FSR, large mature cottonwood trees should be protected from management activities that could degrade them as suitable habitat for at-risk species. Projects occurring in these areas should incorporate restoration prescriptions, to ensure persistence of this habitat type.

FW-WATER-DC 6 Channel type (width/depth ratio, sinuosity, gradient, etc.) is appropriate for the landscape setting (e.g., landform, geology, and bioclimatic region). Stream channels are vertically and laterally stable.

FW-WATER-O 1 Maintain "properly functioning" and improve at least two “impaired” or “functioning at-risk” watersheds (Watershed Classification Framework) every 10 years using the objectives from Vegetation ERUs, Aquatic Species, Water Resources, and Riparian Management Zones and Wetland Ecosystems.

FW-WATER-O 2 Over 10 years, improve watershed function by decommissioning or mitigating impacts (e.g., maintenance, improvements, or reroutes) on at least 100 miles of route (e.g., system roads, unauthorized routes, and trails) to the point of restoring hydrologic and ecological function.

FW-WATER-G 2 Stream channels should not be altered by new management actions unless necessary for resource protection or ecological restoration purposes.

Analysis of Effects:
This program area has the potential to improve overall soil and vegetation conditions within selected watersheds through restoration projects (e.g., increase herbaceous ground cover with thinning, recontour incised channels, plantings of willows and grasses). However, there would also be the potential for short

term implementation impacts (e.g., disturbance where these restoration efforts occur within MSO habitat). While guidelines could limit impacts from restoration and other activities, not all short term negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* MSO and its habitat.

Effects of Infrastructures, Roads and Trails

There are no desired conditions that guide management and activities in this program area relevant for the MSO. Disturbance from these programs has the potential to disturb nesting and roosting birds or cause the nest to be abandoned:

- FW-ROADS-G 3 New forest roads and other infrastructure (e.g., recreation facilities, airstrips, etc.) should be designed and constructed to limit the delivery of sediment and pollutants to waterbodies.

- FW-ROADS-G 4 When a practical alternative does not exist, the footprint of new roads constructed in the riparian management zone should be as small as practical and the design should include mitigations to minimize or eliminate resource damage to ecological resources. The number of designated stream crossings and the footprint of new roads constructed should be limited to as few as practical to avoid impacts to these features.

FW-ROADS-MA 2 has the potential to help reduce noise and disturbance from unauthorized roads or trails where these restoration actions occur within MSO habitat, although the road removal activity itself has the potential to disturb MSO, if present.

Analysis of Effects:
This program area could disturb nesting or rooting MSO during road and trail maintenance activities like: brush removal/mowing, tree removal, grading or public use for recreation activities. Habitat fragmentation can occur if new trails or roads are constructed adjacent or in a PAC or in Critical Habitat. It could also improve some areas where MSO may be present, although there could also be short term impacts to remove unauthorized roads or trails. While standards and guidelines could limit impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* MSO and its habitat.

Effects of Wildlife, Fish and Plants

There are six relevant desired conditions that guide management and activities here. Desired conditions 1 and 2 direct management toward the recovery of MSO and its habitat and address the threat to MSO from noise and disturbance.

FW-TERRASH-DC 1 Terrestrial ecosystems are composed of appropriate (native) assemblages of sustainable populations of plant and animal species that are supported by healthy ecosystems.

a) A diversity of habitat components, including biotic and abiotic features, are available at the appropriate spatial, temporal, compositional, and structural levels (as defined by Desired Conditions for each Vegetation ERU) to provide adequate opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so that forest species remain viable and persistent on the landscape.

b) Undesired nonnative and invasive terrestrial species, as well as introduced pathogens, are rare or absent (per Desired Condition 1 in Wildlife: Nonnative and Invasive Species).

c) Terrestrial habitats allow for the maintenance and promotion of interspecific relationships at all trophic levels (e.g., producer-consumer and predator-prey relationships) across multiple scales, consistent with existing landforms and topography.

FW-TERRASH-DC 2 Habitat configuration, connectivity, and availability allow wildlife populations to adjust their movements in response to major disturbances (e.g., climate change or uncharacteristic fire) and promote genetic flow between wildlife populations.

FW-TERRASH-DC 3 Wildlife are free from harassment and human disturbance at a scale that does not impact vital functions of populations (e.g., breeding, feeding, rearing young, migration, and dispersal) resulting in a negative impact to the persistence of the species in the forest.

FW-TERRASH-O 2 Restore or enhance at least 50,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan. This may be done in conjunction with objectives for treatments in the vegetation section.

FW-TERRASH-G 1 Human-made structures (e.g., fences, steel posts, or vent pipes) should be constructed and maintained to minimize wildlife mortality (e.g., capped fence posts) and removed when no longer needed.

FW-TERRASH-G 2 Infrastructure (e.g., fences and roads) should be designed, modified, or removed to minimize impacts on wildlife movement and improve habitat connectivity.

FW-TERRASH-G 3 Activities negatively impacting wildlife reproduction or other vital functions should be minimized (e.g., closures during elk calving), except if management activities are implemented to control wildlife populations to protect the overall health of the habitat or other populations (e.g., NMDGF regulations).

FW-TERRASH-G 4 Management activities that inhibit the reproduction of an individual raptor (disturbing the same nest site) should be avoided in successive years (e.g., via the development of species -specific distance buffers focusing around known nest sites).

FW-ATRISK-DC 1 Ecological conditions (physical and biotic) contribute to the survival and recovery of federally listed, proposed, and candidate species; preclude the need for listing new species; and allow for the recovery and persistence of species of conservation concern.

FW-ATRISK-DC 2 Intact, functioning, and sufficient habitat for terrestrial and aquatic at-risk species (defined by Desired Conditions for each Vegetation ERU) provide for opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so the species remains viable and persistent on the landscape.

FW-ATRISK-DC 3 Habitats for at-risk species, including rare and endemic populations, are known (locations) to be intact, functioning, well-connected, and sufficient for species' persistence.

FW-ATRISK-G 2 Project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan.

FW-ATRISK-G 5 The forest should use the most current ecological guidelines to improve nesting conditions for goshawk (*Accipiter gentilis*):

a) A minimum of three goshawk nest areas and three replacement nest areas should be located per goshawk territory. Goshawk nest and replacement nest areas should generally be located in drainages, at the base of slopes, and on northerly (northwest to northeast) aspects. Nest areas should generally be 25 to 30 acres in size.

b) Goshawk post-fledging areas of approximately 420 acres should be designated surrounding nest sites.

c) In goshawk foraging areas and post-fledging family areas, groups of three to five reserve trees should be retained within management-created openings greater than 1 acre in ponderosa pine communities, and six reserve trees (VSS class 5 or 6) should be retained within management-created openings greater than 0.5 acre in spruce-fir communities.

d) In occupied goshawk nest areas, human presence should be minimized between March 1 and September 30 (per Guideline 1a in this section).

FW-ATRISK-G 11 Even-aged management treatments in piñon-juniper habitat should avoid creating a sharp, well-defined edge between dense woodlands and recovered shrublands for foraging habitat of at-risk species.

FW-ATRISK-G 12 Large mature cottonwood trees should be retained as habitat for at-risk species unless necessary to meet management objectives or ensure public safety.

FW-ATRISK-MA 1 Work collaboratively with other agencies (e.g., USFWS, NMDGF, New Mexico State Forestry, etc.), universities, and nongovernmental organizations for the research and management of at risk species. Emphasis is placed on the protection and restoration of key habitats and habitat features that lead to their recovery and persistence.

FW-ATRISK-MA 3 Prior to management actions, conduct surveys to identify sessile (immobile) at-risk species in areas with the following features:

a) Limestone outcropping

b) Gypsum soils

c) Sandstone blended with Todilto gypsum or limestone

d) Gray to red shales and clays of the Mancos and Chinle formations in piñon-juniper woodlands

e) Volcanic pumice and unconsolidated pyroclastic ash in piñon-juniper woodland and lower montane coniferous forests

FW-ATRISK-MA 4 Consider guidance from regional or local species conservation agreements, assessments, strategies, or guidelines to improve the status of at-risk species.

FW-ATRISK-MA 5 Consider using geographic information systems (GIS) as the preferred database of record to record findings of at-risk species, including negative surveys.

FW-ATRISK-MA 7 Collaborate with universities, State and Federal agencies (e.g., Forest Service Research and Development, U.S. Geological Survey, Natural Resources Conservation Service, New Mexico State Forestry, New Mexico Department of Game and Fish), and other organizations (e.g., The Nature Conservancy, Natural Heritage New Mexico, Native Plant Society of New Mexico, Trout

Unlimited, Audubon Society, and other non-governmental organizations), to obtain data and encourage research on rare and endemic species.

Analysis of Effects:
This program area could reduce impacts to MSO and its habitat, although monitoring or habitat assessments could result in short term disturbance impacts to MSO and possibly some limited trampling of prey habitat. While guidelines could limit project or activity impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect MSO and its habitat.*

Effects of Designated Areas, Management Areas and Geographic Areas

There are four relevant desired conditions that guide management and activities here:

DA-WILD-DC 1 Designated wilderness areas exhibit wilderness character.

a) Wilderness represents an environment that is essentially an unmodified and natural landscape. Constructed features exist only when they reflect the historic and cultural landscape, when they are the minimum necessary for administration of the area as wilderness, or for the protection of resources.

b) Natural processes (e.g., insects and disease and fires) function within their natural ecological role.

c) Wilderness provides recreation opportunities where social encounters are infrequent and occur only with individuals or small groups, so there are opportunities for solitude. Visitors experience self-reliance, challenge, and risk while enjoying freedom to pursue non-motorized or mechanized activities with only the regulation necessary to protect wilderness character.

GA-CANNAC-DC 1 Headwaters are bountiful with high water quality and support ecological resources and multiple uses, including acequias.

Ponderosa pine and piñon-juniper forest restoration and meadow protection is needed throughout this GA. The thinning of dense, small-diameter trees and shrubs in combination with prescribed burning, will support long-range restoration efforts and reinstate natural fire regimes. Restoration will result in decreased woody encroachment of meadows, restored and preserved grasslands, improved watershed health, and greater wildlife diversity.

GA-NJEMM-DC 1 Prescribed and natural fires protect, maintain, and enhance resources and move toward vegetative desired conditions on a landscape scale throughout the North Jemez Mountains Geographic Area, especially around reservoirs.

Traditional cultural uses by surrounding communities for hunting, grazing cattle, piñon harvesting, and fuelwood gathering is the leading human use of the North Jemez Mountains GA. Small local communities that dot the landscape between forestland boundaries, and occupy inholdings throughout this GA, have depended on forest access and products for centuries and continue to rely on the GA to sustain local livelihoods and culture.

GA-WSANCAJA-DC 1 Most fire burns with low and moderate intensity and there is a very low risk of uncharacteristic wildfire in the wildland-urban interface of Santa Fe and the city of Santa Fe’s water sources (e.g., Santa Fe watershed and Buckman Diversion).

The West Sangres and Caja GA is a popular recreation destination for locals and tourists, which has resulted in increased pressure on developed campsites and trails. Recreation requires new strategies to improve high-use and developed recreation while decreasing user conflicts. In addition, overly dense forests in this GA increase the risk of uncharacteristic, stand-replacing wildfire in the extensive wildland-urban interface along the border of the city of Santa Fe and the Santa Fe Municipal watershed, requiring forest restoration such as thinning and prescribed burning of dense, small-diameter vegetation.

DA-WSR-G 1 Wild sections of the Rio Chama, Pecos, and East Fork of the Jemez Rivers should:

a) be kept free of impoundments;

b) meet or exceed State standards for water quality;

c) be accessible only by trail; and

d) Have shorelines kept in an essentially primitive condition (e.g., essentially free of structures, diversion works, and modifications of the waterway such as rip-rapping and channelization).

DA-WSR-G 4 Mitigations should be implemented to protect and enhance ORVs, free-flowing characteristics, and riparian habitats from range management activities in the Rio Chama WSR corridor.

MA-RECWILD-S 1 Natural processes shall be maintained within recommended wilderness management areas.

a) Fires shall function in their natural ecological role.

b) Insect and disease infestations shall be allowed to run their natural course except where they unacceptably threaten wilderness characteristics.

c) Nonnative invasive species shall be treated using methods and in a manner consistent with wilderness characteristics, or in order to allow natural processes to occur in a recommended wilderness management area.

MA-RECWILD-G 2 Intervention in natural processes through management activities should only occur where this would move the area toward desired conditions, preserve wilderness characteristics, protect public health and safety within and adjacent to the recommended wilderness management area, or uphold other Federal laws and regulations.

a) Unplanned and planned ignitions should be allowed to reduce the risks and consequences of uncharacteristic wildfire to increase apparent naturalness, or to enhance ecosystem function.

Analysis of Effects:
This program area could impact MSO through disturbance during breeding season and impacts to habitat, especially where there may be concentrated gatherings of people and their animals. Recreation activities such as OHV use, rock climbing, geo-caching, or camping have contributed noise and disturbance in MSO habitat. Effects are variable depending on time of day/night, intensity, frequency, and distance to MSO. Some developed recreation sites are within MSO habitat and some are adjacent to PACs; however, these sites have been in place for decades. Persistent noises are likely more disruptive than infrequent disturbances, and intensity of disturbance is proportional to noise level. Trampling, and vegetation removal can reduce forage for prey species. There could be some habitat improvement where campsites are rehabilitated but recreation at these sites could still impact MSO. While standards and guidelines

could help limit impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* MSO and its habitat.

Oil and Gas Leasing Area

MA-OGLEASE-S 1 the following timing limitations apply to drilling operations and construction activities. These do not apply to daily operation and maintenance of producing wells.

a) Prohibited during the Mexican spotted owl's critical nesting and breeding period (between March 1 and August 31) to ensure reproductive and post-fledgling success within Mexican spotted owl protected activity centers. An exception, modification, or waiver to the timing limitation may be granted if surveys according to protocol are conducted and the area is not used for nesting. A public notice and comment period is required prior to waiver, exception, or modification waiver of this stipulation.

b) Prohibited during the northern goshawk's critical nesting and breeding period (between March 1 and September 30) to ensure reproductive and post-fledgling success within northern goshawk nesting post-fledging area. An exception, modification, or waiver to the timing limitation may be granted if northern goshawk surveys show that the area is not used for nesting.

c) Prohibited during the peregrine falcon's critical nesting and breeding period (between March 1 and August 15) to ensure reproductive and post-fledgling success within designated peregrine falcon eyries. An exception, modification or waiver to the timing limitation may be granted if surveys show that the area is not used for nesting.

d) Prohibited in the deer and elk winter range along the northwestern edge of the oil-gas study area (between December 15 and March 15). An exception, modification, or waiver to the timing limitation may be granted if the operator demonstrates that the drilling and construction location would not disrupt deer and elk winter habitat.

e) Prohibited during the critical deer fawning and elk calving period (between June 1 and July 31) to minimize risks to herd reproduction within important deer fawning and elk calving area within an area in the southern portion of the oil-gas study area that has been identified as important to the success of deer fawning and elk calving. An exception, modification, or waiver to the timing limitation may be granted if the operator demonstrates that the drilling and construction location would not disrupt deer fawning and elk calving.

f) To protect and limit disturbances from drilling activities to at-risk species and other critical wildlife habitat areas, timing restrictions outlined in current and future Federal recovery plans or forest-defined protected activity centers must be followed.

MA-OGLEASE-S 1 has the potential to help limit the threat of noise and disturbance within MSO PACs adjacent to or near private land.

MA-OGLEASE-G 2 has the potential to avoid adverse impacts to riparian and wetland resources, as it states that access roads and pipelines should not be located in riparian TEUs (or equivalent survey system) or where vegetation data indicates riparian or wetland conditions, unless there are no practical alternative locations and they are located and designed to minimize adverse impacts to riparian or wetland resources.

Analysis of Effects:

This program area could impact MSO habitat with mineral extraction, special use facilities (e.g., powerlines), or energy exploration and associated activities, although impacts are generally more localized and limited. While standards and guidelines could limit impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* MSO and its habitat.

Effects on **Critical Habitat and Primary Constituent Elements**

Effects to occupied, suitable, recoverable or dispersal habitat discussed above would apply to proposed critical habitat for this species. Table 13 shows which program areas may impact specific critical habitat PCEs in either a positive or negative manner. It is important to note that LMP implementation would not necessarily have these impacts across all critical habitat for the MSO on the Santa Fe NF.

Table 13. MSO critical habitat PCEs potentially impacted by program area

Program Area	Affected PCEs (by number) and Principle Mechanism
Wildland Fire Management	1, 2, and 3. Potential to reduce uncharacteristic wildfire; also prescribed burning potential to reduce snags, woody species regeneration, canopy cover, and herbaceous prey habitat.
Ecosystem/Vegetation Health(Forest Products)	
Watershed and Soil Management (Riparian Areas)	1 and 2. Impacts to soil and vegetation during treatments.
Engineering	1, 2, and 3. Road building or maintenance impacts to habitat (woody and herbaceous vegetation).
Lands and Minerals (Special Uses)	1 and 2. Some site specific impacts to forest structure.
Recreation and Wilderness	1, 2 and 3. Recreation vehicle and foot impacts to riparian vegetation and disturbance of ground litter and woody debris.
Wildlife, Fish, and Rare Plants	2. Potential for limited short term impacts from trampling of prey habitat during monitoring or habitat assessments.

PCE 1 Forest structure
All program areas are likely to impact regeneration of woody species and herbaceous plant prey habitat. Most are likely to impact forest canopy cover and snag persistence through burning or thinning to some level.

PCE 2 Adequate prey species
Some program areas are likely to impact the amount of down woody material while others are likely to influence the density and vigor of herbaceous vegetation through foot, hoof, or equipment action.

PCE 3 Canyon habitat components
Some program areas are likely to impact the tree density that supports the cool microclimate needed to sustain MSO in canyon habitat; these are also likely to impact ground litter and woody debris.

Overall, essentially all program areas are likely to have some negative impacts to MSO primary constituent elements of critical habitat. However, it is important to note that LMP implementation would not necessarily have these impacts across all critical habitat for the MSO on the Santa Fe NF.

Cumulative Effects and Climate Change

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area of impacts for a listed species. Timber harvest, prescribed burning activities, and livestock grazing occur on the adjacent nonfederal lands. The PACs adjacent to or within about 300 feet of adjacent to private land may be subject to disturbance associated with residential, business, livestock grazing, and other activities.

The implications for MSO of climate change and variability with greater extremes of temperature and moisture could include declining acreage of forested habitat, greater risk of insect and disease impacts to habitat, and greater risk of stand-replacing wildfire.

Summary and Determination of Effects

Summary

Vegetation Management

Potential effects, both positive and negative, from mechanical harvest and thinning are listed below. These Programs have the potential to directly impact the MSO and proposed critical habitat through removal and fragmentation of habitat. Broad-scale, high-severity, stand replacing fires have had, and will likely continue to have, long-term effects on both watershed and forest function (Fulé et al. 2004). Wildland fires can cause direct and indirect effects from combustion, charring, heating, smoke, and biophysical changes to the burned area. Dense forests with heavy fuel accumulations, like many forests in the southwestern U.S., are at greater risk to high-severity and stand-replacing fires (Fulé et al. 2004).

The potential effects of fire and related activities on owls depend upon:

- whether or not the fire and/or suppression activities are within owl habitat;
- type of habitat involved (e.g., nest/roost, foraging, dispersal habitat);
- severity and intensity of the wildland fire;
- areal extent, location, and intensity of suppression activities;
- frequency and cumulative effects of the suppression activities; and,
- time of year
- High-severity burns have the most negative long-term effects on spotted owl nest and roost habitats but could enhance foraging habitats used by owl prey species (e.g., woodrats or deer mice) (Franklin et al. 2000, Kyle and Block 2000).
- Effects of future fire on the owl's habitat will very likely depend on the type of habitat that is occupied.
- Fire-suppression activities can result in habitat loss through building of fire lines, construction of support areas such as helipads and fire camps, and ignition of backfires and burnouts to reduce the amount of fuel available to the wildland fire.
- Although fire-suppression activities can have significant negative effects on owl habitat, at least locally, fire suppression tactics like backfires and burnouts can also be used to reduce fire severity and canopy losses.
- Fuelwood harvest can result in the loss of habitat components such as hardwoods (especially

Gambel oak), snags, large logs, and large woody riparian vegetation used by prey species.

- Short term impacts would include change in stand structure which may impact nesting and foraging habitat; noise from thinning operations which would cause disturbance to any individuals in the area at the time of operations.
- Would benefit MSO and prey habitat by providing an open stand with various structural stages.

Livestock grazing

- Vegetation trampling and grazing, inhibit recovery to vegetation potential (composition, density, height) in riparian and adjacent upland areas; sufficient space (length of riparian area for travel corridor).
- Vegetation productivity and ultimate changes in species composition, density, and vigor, which can degrade spotted owl prey habitat characteristics over the long-term.
- Grazing within riparian areas can also result in soil compaction, herbaceous removal, physical damage to plants, and changes in fluvial processes (Trimble and Mendel 1995)
- Grazing results in the loss of vegetative cover and depletion of food resources
- Properly managed grazing in key owl foraging areas that consistently maintains residual herbaceous biomass of forage species, sufficient to allow for individual plants to recover and reproduce during most growing seasons, should provide cover and food sources for some prey species (especially during drought periods).

Restoration by wildfire and prescribed fire

Catastrophic wildfire is an imminent threat to the MSO and proposed critical habitat. Fire management activities directly address this threat. Fire activities can be both interrelated/interdependent (suppression activities), or direct actions (e.g., prescribed fire, fire risk abatement). Prescribed fires can have a positive effect on the MSO by reducing ladder fuels and fuel loads.

- Fire may reduce encroachment of woody species where the densities of woody species is outside the range of natural variability for riparian ERUs in the Santa Fe NF, encouraging the return of natural fire regimes and restoring native ground cover.
- The use of wildland fire provides for desired stand conditions including maintaining species needed by wildlife.
- After a landscape scale fire, it also provides for reestablishment of native plants needed by wildlife and their prey.

Road Decommissioning

Road decommissioning is a common restoration practice which involves using heavy equipment to treat the road prism to reduce erosion and hydrologic impact. Levels of treatment range widely, but generally requires decompacting the road and may involve removing the road prism and reshaping the area to match natural hillslope contours.

Dispersed recreation

Recreation can cause habitat degradation and disturbance from human activity, and potentially habitat removal (including proposed critical habitat) if new facilities are developed. Dispersed recreation areas can be detrimental to riparian areas where human use concentrates in riparian areas adjacent to streams and wetland features. Detrimental effects intensify if sites are accessed by motorized vehicle.

- Concentrated human use can destabilize soils by foot and vehicle traffic damaging aquatic habitat and water quality through loss of vegetation and increased sedimentation. Water quality can be further degraded by human waste, fuel (for stoves, ATVs, etc.), and other contaminants that are introduced to waterbodies. Restoring dispersed sites can have the long term positive impacts on vegetation and water quality and have short-term negative impacts.

- Dispersed sites that are merely closed and not actively rehabilitated will not experience the short-term impacts from heavy equipment use in riparian areas but also will not likely improve or recover completely on their own. Sites will remain compacted from years of vehicle traffic; the compaction will inhibit revegetation leaving exposed soils and vulnerabilities to invasive plant encroachment. The compacted bare ground will prevent infiltration of precipitation, which will cause continued runoff and erosion degrading water quality.

Determination of Effects

Overall LMP direction is to maintain or restore desired conditions for forest, woodland, and riparian forest ERUs needed to support MSO. Protection of PACs may require active management in forested habitat to reduce fuel loads and fuel continuity in areas adjacent to and within these areas to reduce potential for high severity and stand-replacement fires. In many cases, strategic treatments on surrounding and/or adjoining lands will reduce fire risk sufficiently so that, in the short term, treatments are not needed within PACs (Ager et al. 2007, Finney et al. 2007, Ager et al. 2010). Where fuels treatments are deemed necessary within PACs, managers must balance fuels reduction goals with short- and long-term conservation of owl habitat, recognizing that drastic alterations to PACs may render them of lesser value for Mexican spotted owls, at least in the short term.

Planned ignitions (prescribed fire) and unplanned ignitions (wildland fire) should be allowed to enter cores only if they are expected to burn with low fire severity and intensity. Fire lines, check-lines, backfiring, and similar fire management tactics can be used to reduce fire effects and to maintain key habitat elements (e.g., hardwoods, large downed logs, snags, and large trees).

Other activities should be conducted outside of the breeding season unless pressing reasons dictate otherwise. These activities include trail maintenance, road repair, removal of hazard trees, and utility-line maintenance. If the activity is conducted during the breeding season with owls present, owl locations should be known and documented during the conduct of the management action. Management actions should not be conducted in the vicinity of nesting owls, where vicinity is defined by the intensity of disturbance.

Standards and guidelines are designed to limit the extent, level, and duration of potential short term effects; however, LMP implementation does not provide for mitigation of all potential effects to a level that can be equated to or considered insignificant and/or discountable. Overall LMP direction is to maintain or restore desired conditions for ERUs, watersheds, and riparian areas and has the potential to maintain or improve habitat conditions.

However, LMP implementation does not provide for mitigation of all potential effects to a level that can be equated to or considered insignificant and/or discountable. Therefore, it is determined that LMP implementation *may affect and is likely to adversely affect* the MSO and *it may affect and is likely to adversely affect* critical habitat for this species.

Jemez Mountain Salamander (*Plethodon neomexicanus*)

- Endangered Species Act Status: Endangered, 2013
- Recovery Plan, First Revision:
- Critical Habitat: December 20, 2013
- District Occurrence: Coyote, Jemez, Cuba Ranger Districts.
- Determination of Effects (species): ***May Affect, Likely to Adversely Affect***
- Determination Effects (critical habitat): ***May Affect, Likely to Adversely Affect***

For brevity, the Jemez Mountains salamander is referred to as JMS throughout the document.

Status of Species and Habitat

Legal Status and Description

The Jemez Mountains salamander (*Plethodon neomexicanus*) is a federally endangered species endemic only to the Santa Fe NF. It was listed as endangered in 2013. It feeds primarily on invertebrates. Threats include habitat loss from severe wildfire or other activities that alter hydrology and disease including chytrid fungus. Grazing is believed to be a vector for chytrid fungus when livestock carry it into the habitat from water sources where it can be present. Wildlife can also carry the fungus now, but did not do so in the past, as chytrid fungus was not known to be present under reference conditions. This species is usually present in its habitat year-round and spends much of its life underground. However, it may be found at the surface July through September, when conditions are suitable.

In 2013, the Service designated 90,716 acres of land as critical habitat for the federally threatened Jemez Mountain salamander (Plethodon neomexicanus). The habitat designation is broken up into two units. Both units are within the geographical area occupied by the salamander and contain elements of essential physical or biological features. The physical or biological features require special management or protection from large-scale, stand-replacing wildfire; actions that would disturb salamander habitat by warming and drying the ground; actions that reduce the availability of aboveground cover objects including downed logs; or actions that would compact or disturb the soil or otherwise interfere with the capacity of salamanders to move between subterranean habitat and aboveground habitat (USFWS 2013).

Unit 1 consists of 42,445 acres in Rio Arriba and Sandoval Counties, New Mexico, in the western portion of the Jemez Mountains. In Unit 1, 41,466 acres are federally managed, with 26,531 acres on Santa Fe NF lands and 14,935 acres on Valles Caldera National Preserve lands; 73 acres are New Mexico Department of Game and Fish lands; and 906 acres are private lands. This unit is located in the western portion of the distribution of the Jemez Mountains salamander and includes Redondo Peak, which is on the Valles Caldera National Preserve.

Unit 2 consists of 48,271 acres in Los Alamos and Sandoval Counties, New Mexico, in the eastern, southern, and southeastern potions of the Jemez Mountains. In Unit 2, 46,375 acres are federally managed, with 30,366 acres on Santa Fe NF lands, 8,811 acres on Valles Caldera National Preserve lands, and 7,198 acres on National Park Service lands (Bandelier National Monument). The remaining 1,897 acres in Unit 2 are on private lands.

Critical Habitat and Primary Constituent Elements

The Jemez Mountains salamander final critical habitat rule designated approximately 90,716 acres (ac) (36,711 hectares [ha]) as critical habitat in two units in the Jemez Mountains, New Mexico (USFWS, 2013b). Unit 1 consists of 42,445 ac (17,177 ha) in Rio Arriba and Sandoval Counties, New Mexico, in the western portion of the Jemez Mountains. In this critical habitat unit, 41,466 ac (16,781 ha) is federally managed, with 26,531 ac (10,736 ha) on Forest Service lands and 14,935 ac (6,044 ha) on Valles Caldera National Preserve (VCNP)/National Park Service lands, 73 ac (30 ha) on New Mexico Department of Game and Fish lands, and 906 ac (367 ha) on private lands. Unit 2 consists of 48,271 ac (19,535 ha) in Los Alamos and Sandoval Counties, New Mexico, in the eastern, southern, and southeastern portions of the Jemez Mountains. In this critical habitat unit, 46,375 ac (18,767 ha) is federally managed, with 30,366 ac (12, 288 ha) on Forest Service lands, 8,811 ac (3,565 ha) on VCNP lands, and 7,198 ac (2,912 ha) on Bandelier National Monument/National Park Service lands, and 1,897 ac (768 ha) on private lands. The status of designated critical habitat has not changed significantly from that published in the final rule.

Primary constituent elements specific to the Jemez Mountains salamander are:

a) Moderate to high tree canopy cover, typically 50 to 100 percent canopy closure, that provides shade and maintains moisture and high relative humidity at the ground surface, and:

    a) Consists of the following tree species alone or in any combination: Douglas fir (*Pseudotsuga menziesii*); blue spruce (*Picea pungens*); Engelman spruce (*Picea engelmannii*); white fir (*Abies concolor*); limber pine (*Pinus flexilis*); Ponderosa pine (*Pinus ponderosa*); and aspen (*Populus tremuloides*); and

    b) Has an understory that predominantly comprises: Rocky Mountain maple (*Acer glabrum*); New Mexico locust (*Robinia neomexicana*); oceanspray (*Holodiscus spp*.); or shrubby oaks (*Quercus spp*.).

b) Elevations from 6,988 to 11,254 ft (2,130 to 3,430 m).

c) Ground surface in forest areas with:

    a) Moderate to high volumes of large fallen trees and other woody debris, especially coniferous logs at least 10 in (25 cm) in diameter, particularly Douglas fir, which are in contact with the soil in varying stages of decay from freshly fallen to nearly fully decomposed; or

    b) Structural features, such as rocks, bark, and moss mats, that provide the species with food and cover.

d) Underground habitat in forest or meadow areas containing interstitial spaces provided by:

    a) Igneous rock with fractures or loose rocky soils;

    b) Rotted tree root channels; or

    c) Burrows of rodents or large invertebrates.

The features essential to the conservation of this species may require special management considerations or protection to reduce the following threats: historical and current fire management practices; severe wildland fire; conversions of forest composition and structure; post-fire rehabilitation; forest management (including silvicultural practices); roads, trails, and habitat fragmentation; recreation; and climate change.

Furthermore, disease and the use of fire retardants or other chemicals may threaten the salamander, and may need special management considerations.

Life History and Habitat

The Jemez Mountains salamander (JMS) is a federally and New Mexico state-listed endangered species with critical habitat that is endemic to the Jemez Mountains in Sandoval, Los Alamos, and Rio Arriba Counties of north-central New Mexico (Degenhardt et al. 1996, USFWS 2013a, 2013b). This species is usually present in its habitat year-round and spends much of its life underground. However, it may be found at the surface July through September, when conditions are suitable.

Distribution, Abundance, and Trend

The Jemez Mountains salamander is one of two species of plethodontid salamanders endemic (native and restricted to a particular region) to New Mexico: the Jemez Mountains salamander and the Sacramento Mountains salamander (*Aneides hardii*). Unlike most other North American plethodontid salamanders, these two species are geographically isolated from all other species of *Plethodon* and *Aneides*. The salamander is restricted to the Jemez Mountains in northern New Mexico, in Los Alamos, Rio Arriba, and Sandoval Counties, around the rim of the collapsed caldera (large volcanic crater), with some occurrences on topographic features (e.g., resurgent domes) on the interior of the caldera. The majority of salamander habitat is located on federally managed lands, including the USFS, the National Park Service (Bandelier National Monument), Valles Caldera National Preserve (VCNP), and Los Alamos National Laboratory, with some habitat located on tribal land and private lands (NMEST 2000).

The total population within the salamander's entire range is unknown but is likely to exceed 10,000 ((NatureServe 2019). Known locations of JMS have increased over decades due to more frequent and intensive surveys. In 1967, seven localities of JMS were known (Reagan 1967). In 1974, ten localities were known and another thirteen were added after surveys were conducted, totaling twenty-three localities (Degenhardt 1974). All of these locations were on SFNF lands. Of the twenty-three locations, salamanders were abundantly found in seventeen sites.

Salamander detection is highly variable, as this species is secretive, subterranean, and only active during specific environmental conditions. When a site is surveyed and found to be absent of salamanders it does not unequivocally indicate this species is not present (Cummer 2003; Everrett 2003; Ramotnik 2003).

Threats

Threats include habitat loss from severe wildfire or other activities that alter hydrology and disease including chytrid fungus. Grazing is believed to be a vector for chytrid fungus when livestock carry it into the habitat from water sources where it can be present. Wildlife can also carry the fungus now but did not do so in the past as chytrid fungus was not known to be present under reference conditions.

Status of the Species and Habitat in the Action Area

Status of Species within the Action Area

Based on collection data dating back to 1952 there are over 650 known observations of JMS within the Jemez mountains. Some of these observations fall within the boundary of the Valles Caldera but the majority of salamanders have been discovered on slopes and drainages within the SFNF. Data limitations, comprehensive survey costs, and the likelihood of natural, annual, and spatial variations make determining overall species population trends difficult. Current ecological conditions in the proposed action area, particularly for wildfire, are highly departed from reference conditions.

Status of Habitat within the Action Area

There are 22,974 hectares (56,770 acres) of designated critical habitat on the Santa Fe NF. Threats include habitat loss from severe wildfire and the current presence of chytrid fungus. Wildlife can carry the fungus but did not do so in the past as chytrid fungus was not known to be present under reference conditions.

Conservation Measures: Conservation Actions 7 (a)(1)

No specific conservation actions have been implemented for the Jemez Mountain salamander on the Santa Fe; however, a Forest Plan guideline requires that project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan. The proposed action also includes management approaches for at-risk species. These would further help to provide persistence for the mouse throughout its range by promoting collaborative partnerships to aid in recovery and delisting and to consider habitat fragmentation on adjacent lands when planning activities on the Santa Fe. They include the following:

Management Approaches (FW-ATRISK-MA-1 and FW-ATRISK-MA-2)

Effects Analysis for Jemez Mountain Salamander

In the individual program area discussions below, the implication of relevant desired conditions to JMS are noted. Potential impacts of each objective, standard, and guideline to the species and habitat are described. Where applicable, management areas are addressed. A determination of effects is then made for that program area. Subsequent to all program areas, an overall determination of effects for this species and its proposed critical habitat from LMP implementation is provided in the Summary of Effects and Determinations section for JMS.

Effects of Frequent Fires and Grass Cover

There are 12 relevant desired conditions that guide management and activities here (see Table 8). Desired conditions in ALL FW-VEG-DC, and FW-WUI-DC 2 and 3 and FW-FIRE-DC 2 and 3 directs management toward activities and conditions where fire is again able to play its historic role in maintaining fire adapted ecosystems; this would reduce the threat of stand-replacing or uncharacteristic wildfire to JMS and habitat.

Desired conditions within the proposed action explicitly defines the percentage of seral states in each forested ERU (i.e. early, mid-, and late-) (ALL FW-PPF-DCs, ALL FW-MCD-DCS) They also provide guidance on tree size class, vegetation structure, fire return interval, dominant understory vegetative species types, as well as specific ecological conditions indicative of a healthy ecosystem. The proposed action sets a maximum objective within MCD and PPF of 280,000 to 350,000 acres of restoration work to be completed respectively, over a 10-year period. The desired conditions in the proposed action calls for 72 percent of MCD to be open canopy. The objectives, standards, and guidelines in the proposed action would reduce this risk of catastrophic fire by moving toward desired conditions which call for 86 percent of PPF to be open canopy. This would improve seral state and reduce the likelihood that uncharacteristic fire would negatively impact on JMS.

FW-WUI-DC-1 Wildland fires in the WUI do not result in the loss of life, property, or characteristic ecosystem function.

FW-WUI-DC-2 Wildland fires in the WUI are low to moderate intensity surface fires. Firefighters are able to safely and efficiently suppress wildfires in the WUI using direct attack.

FW-WUI-DC-3 Ecosystem structure promotes low-intensity surface fires in areas where the WUI intersects vegetation types with a mixed- or high-severity fire regimes (e.g., SFF and MCW).

a) Tree basal area reflects the low end of the range within the desired conditions for individual vegetation types.

b) Ladder fuels are nearly absent.

c) Openings between tree groups are of sufficient size to discourage isolated group torching from spreading as a crown fire to other groups. Trees within groups may be more widely spaced with less interlocking of the crowns than desirable in adjacent forest lands. Openings with grass/forb/shrub vegetation occupy the mid to upper end of the percentage range in the desired conditions.

FW-FIRE-DC-1 Wildland fires do not result in the loss of life, property, or cultural resources, or create irreparable harm to ecological resources.

FW-FIRE-DC-2 Wildland fire protects, maintains, and enhances resources. It is allowed to function in its natural ecological role on a landscape scale and across administrative boundaries, under conditions where safety and values at risk can be protected.

FW-FIRE-DC-3 Wildland fires burn within the range of severity and frequency of historic fire regimes for the affected vegetation communities. High-severity fires rarely occur where they were not historically part of the fire regime.

FW-FIRE-DC-4 naturally caused fires predominate; accidental human-caused fires (e.g., abandoned campfire, downed powerlines) are rare.

FW-FIRE-DC-5 Fires function in their natural ecological role in designated areas (e.g., wilderness and research natural areas).

FW-FIRE-DC-6 Restoration and fuel treatments result in ecological resources that are adaptable to changing climate conditions.

FW-FORESTRY-DC-4 Non-commercial and commercial timber harvest supplement restoration and maintenance treatments at a scale that achieves landscape desired conditions and contribute to watershed restoration function and resilience, wildlife habitat enhancement, small and large business and employment opportunities, and provide wood products.

FW-FORESTRY-DC-5 Harvest of dead and dying trees for economic value is consistent with the desired conditions of wildlife habitat, soil productivity, and ecosystem functions.

FW-VEG-O-1 Over a 10-year period, complete at least the following treatments to move vegetation resources toward desired conditions:

Vegetation ERU	Mechanical Treatment (acres)	Prescribed Fire and Naturally Ignited Wildfire (acres)
Mixed Conifer with Frequent Fire (MCD)	10,000–80,000	50,000–200,000
Ponderosa Pine (PPF)	15,000–100,000	150,000–250,000

FW-VEG-O-2 Over a 10-year period, complete 2,500 to 50,000 acres of combined vegetation treatments in highly departed non-forested ERUs to move vegetation toward desired conditions (i.e., restoration). Treatments may include mechanical treatments, prescribed fire or naturally ignited wildfires, seeding, or other techniques still to be determined by best available science depending on the specific ERU. Highly departed non-forested ERUs are juniper grass (JUG), piñon juniper grass (PJG), Colorado Plateau Great Basin grassland (CPGB), sagebrush shrubland (SAGE), and montane subalpine grassland (MSG).

FW-VEG-G-1 1Management activities should favor the retention of species that naturally occurred in those ecosystems. Native species should be present in the relative proportions characteristic of those ecosystems.

FW-FIRE-G-1 Naturally occurring fires should be allowed to perform their natural ecological role to meet multiple resource objectives and facilitate progress toward desired conditions (per desired conditions of various resources throughout the plan).

FW-FIRE-G-8 Post-fire restoration and recovery should be provided where critical resource concerns merit rehabilitation for controlling the spread of invasive species, protecting areas of cultural concern, protecting critical or endangered species habitat, or protecting other highly valued resources such as drinking water.

FW-FIRE-G-9 Higher fire intensities and associated fire effects at the fine scale (less than 10 acres) should be accepted in areas that are moderately to highly departed from desired conditions. Multiple small areas of high mortality are preferable to a single large, high-severity area.

FW-FIRE-G-10 Burn pile composition should contain a mixture of fuel sizes. Large woody fuels, 9 inches in diameter or greater, should be limited to less than 40 percent of the composition of the pile to prevent adverse impacts to the soil.

FW-FIRE-G-11 Depth of masticated materials should not exceed an average of 4 inches and materials should be discontinuous at the quarter-acre scale to protect the soil and allow for natural revegetation.

FW-FORESTRY-S-1 Regulated timber harvest (tree harvest for the purposes of timber production) must occur only on lands classified as suitable for timber production (16 U.S.C. 1604).

a) On lands suitable for timber production, timber harvest intended to create openings for tree regeneration must only be used when there is reasonable assurance of restocking within 5 years after final regeneration harvest.

b) Timber harvest would occur only where soil, slope, or watershed conditions would not be irreversibly damaged.

c) Timber will be harvested only where protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water.

d) Timber harvest will be carried out consistent with the protection of soil, watershed, fish, wildlife, traditional use resources, cultural and historic resources, recreation, and aesthetic resources.

e) Timber will be harvested only where the harvesting system is not selected primarily because it will give the greatest dollar return or unit output of timber.

FW-FORESTRY-G-1 On suitable timberlands, regeneration harvest of even-aged stands should have reached or surpassed 95 percent of the culmination of mean annual increment, unless it is needed to:

a) Reduce fire hazard within the wildland-urban interface (WUI),

b) Contribute toward achieving the desired uneven-aged vegetation conditions over the long term, or

c) Treats unsustainable stand conditions resulting from insects, disease, or other damage agents.

FW-FORESTRY-G-2 Log landing areas should be located outside of mapped sensitive areas (e.g., riparian management zones, wetlands, archeological sites, threatened and endangered critical habitat, and along Scenery Management System Concern Level I Routes). When landings must be located in these areas, effects to the sensitive resource will be mitigated.

Analysis of Effects:
Coarse woody debris levels would also trend toward desired conditions after 50 years, providing organic matter inputs into the soil and creating habitat for species like the Jemez Mountain salamander. The proposed action provides desired conditions that define specific CWD conditions within each forested ERU. This includes specific measures of tons per acre. The proposed action sets a maximum objective of 87,000 acres for restoration work to be completed over a 10-year period within the non-forested ERUs. There are also timber objectives that promote the collection of fuelwood. Both of these objectives would decrease CWD departure and positively affect ecological conditions required by some at-risk species. The following discussion demonstrates how improved CWD conditions would increase the viability for at-risk species

Prescribed fire and mechanical treatments could, over the long term, reduce uncharacteristic wildfire and the associated risk of substantial or complete loss of areas providing JMS protected and recovery habitat. However, activities associated with burning (equipment, personnel) could also result in short term impacts such as disturbance to nesting JMS and temporary loss of herbaceous vegetation needed for cover. While guidelines could help limit these impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* JMS and its habitat.

Effects of Watershed and Soil Management

FW-RWE-DC-4 Riparian areas and wetland ecosystems meet the standards defined by proper functioning condition metrics (e.g., Prichard et al. 1998). RE and WE are supported by surface and subsurface flow regimes that contribute to stream-channel and floodplain development, maintenance, and function; which maintain soil moisture necessary for the regeneration of native plants that depend on flooding or high water tables.

FW-RWE-O-1 Riparian ecosystems move toward desired conditions (less than a 33 percent departure from DC) for vegetation functional diversity, vegetation seral state, riparian corridor connectivity, and flood regime (frequency, duration, and magnitude) by implementing 15 miles of stream every 10 years.

FW-RWE-S-1 Ground-disturbing activities within riparian areas and wetland ecosystems must take measures to avoid introducing new or spreading existing invasive species and pathogens (per Standard 1 in Wildlife: Nonnative Invasive Species).

FW-RWE-G-2 Within RMZs, management activities (e.g., recreation, permitted uses, structural developments such as livestock water gaps, pipelines, or other infrastructure) should occur at levels or scales that move toward desired conditions for water, soils, aquatic species habitat, and vegetation within the sub-watershed in which the management activity is taking place. Activities and facilities with a small footprint (e.g., access points, intermittent livestock crossing locations, water gaps, or other infrastructure) may be necessary to manage larger scale impacts within the RMZ, recognizing there may be trade-offs between activities and resources.

FW-RWE-G-7 Herbivory of riparian plants should not cause long-term trends away from desired riparian conditions.

FW-SOIL-G-1 Ground-disturbing management activities should be designed to minimize short- and long-term adverse impacts to soil resources (e.g., soil compaction and soil loss). Where disturbance cannot be avoided, project-specific soil and water conservation practices should be developed. When soil conditions are less than satisfactory as a result of management activities, restoration of soil condition should occur.

FW-SOIL-G-2 During forest management activities such as thinning and prescribed fire, large woody material should be retained to meet desired conditions relevant to the ERU to support nutrient cycling.

Analysis of Effects:
The Outlet San Antonio Creek sub-watershed (14,800 total acres) is largely managed by the Santa Fe NF (91 percent). There are over 39 miles of streams and over 1,400 acres of riparian vegetation within the sub-watershed. It is potential habitat for the Rio Grande cutthroat trout and is critical habitat to the Mexican spotted owl, the northern goshawk, the Jemez Mountain salamander, and the New Mexico meadow jumping mouse. Impaired WCF metrics for this watershed are: aquatic biota, riparian vegetation, water quality, roads and trails (both density and maintenance), soil condition, and fire condition.

Ground-disturbing management activities should be to minimize short- and long-term adverse impacts to soil resources to reduce effects to JMS protected and recovery habitat. However, activities associated with forest management that has the potential to cause soil movement (equipment, personnel) could also result in short term impacts such as disturbance to JMS. While guidelines could help limit these impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* MJS and its habitat.

Effects of Infrastructures, Roads and Trails

Relevant desired condition that guides management and activities include Facilities, Roads, Recreation (Dispersed and Developed) and special uses (FW-ROADS-DC, FW-RECSU-DC, FW-DISREC-DC). ROADS desired condition 3 directs that the location and design of roads not impede wildlife and fish movement which would help address habitat connectivity and JMS movement and population expansion through riparian corridors.

FW-ROADS-DC-3 Roads do not adversely affect watercourses or sensitive riparian areas.

FW-ROADS-G-7 Reconstruction and rehabilitation of existing roads should be emphasized over new road construction.

FW-ROADS-G-8 Temporary roads (e.g., that support ecosystem restoration activities, fuels management, or other short-term projects) should be closed and rehabilitated (restored to more natural vegetative conditions) upon project completion to protect watershed condition, minimize wildlife disturbance, and prevent illegal motorized use.

FW-ROADS-G-9 Construction of new roads and trails or reconstruction and maintenance of existing roads intersecting fish-bearing streams should accommodate aquatic organism passage.

FW-ROADS-G-10 If at-risk species are present and will be impacted by road construction or maintenance activities, work should be conducted to avoid or minimize noise and habitat disturbance and outside of critical life-cycle periods (e.g., breeding or nesting for birds) or when animals may not be present (e.g., during migration).

Analysis of Effects:
This program area could damage needed soil and vegetation and disturb JMS, primarily related to the presence and maintenance of motorized roads and trails. It could also improve some areas where JMS may be present, although there could also be short term impacts with removal of unauthorized roads or trails. While standards and guidelines could limit impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* JMS and its habitat.

Effects of Wildlife, Fish, and Plants

There are five relevant desired conditions that guide management and activities here. Desired conditions 1 and 2 direct management toward the recovery of JMS and its habitat and address the threat to JMS from noise and disturbance. Desired conditions 2 and 3 provide habitat components for JMS and their prey (e.g., mistletoe and logs).

FW-TERRASH-DC-1 Terrestrial ecosystems are composed of appropriate (native) assemblages of sustainable populations of plant and animal species that are supported by healthy ecosystems.

a) A diversity of habitat components, including biotic and abiotic features, are available at the appropriate spatial, temporal, compositional, and structural levels (as defined by Desired Conditions for each Vegetation ERU) to provide adequate opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so that forest species remain viable and persistent on the landscape.

b) Undesired nonnative and invasive terrestrial species, as well as introduced pathogens, are rare or absent (per Desired Condition 1 in Wildlife: Nonnative Invasive Species).

c) Terrestrial habitats allow for the maintenance and promotion of interspecific relationships at all trophic levels (e.g., producer-consumer and predator-prey relationships) across multiple scales, consistent with existing landforms and topography.

FW-TERRASH-DC-2 Habitat configuration, connectivity, and availability allow wildlife populations to adjust their movements in response to major disturbances (e.g., climate change or uncharacteristic fire) and promote genetic flow between wildlife populations.

FW-TERRASH-O-2 Restore or enhance at least 50,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan. This may be done in conjunction with objectives for treatments in the vegetation section.

FW-ATRISK-DC-1 Ecological conditions (physical and biotic) contribute to the survival and recovery of federally listed, proposed, and candidate species; preclude the need for listing new species; and allow for the recovery and persistence of species of conservation concern.

FW-ATRISK-DC- 2 Intact, functioning, and sufficient habitat for terrestrial and aquatic at-risk species (defined by Desired Conditions for each Vegetation ERU) provide for opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so the species remains viable and persistent on the landscape.

FW-ATRISK-DC- 3 Habitats for at-risk species, including rare and endemic populations, are known (locations) to be intact, functioning, well-connected, and sufficient for species' persistence.

FW-ATRISK-G-1 All authorized activities should be designed and implemented to address threats to at-risk species and their habitats, including, but not limited to:

a) Timing restrictions to encourage reproductive success;

b) Prevention of introduction of non-game invasive, competing, or predatory species (these are species directly and negatively impacting at-risk species populations), and prevention of introduction of nonnative games species to novel locations;

c) Prevention or introduction of pathogens leading to population impacts;

d) Creation or removal of obstructions that may alter natural migration or directly cause mortality to wildlife; and

e) Avoiding or protecting small or isolated populations.

FW-ATRISK-G-2 Project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan.

FW-ATRISK-G-4 Within critical habitat for threatened and endangered species, footprints of ground disturbing fire suppression activities should be as small as possible or located where ground disturbance has previously occurred.

FW-ATRISK-G-8 Heavy equipment should be kept out of streams during spawning, incubation, and emergence periods (e.g., spring to early summer for fish species) of aquatic at-risk species (per Guideline 1a in this section) except when short-term uses are required to improve resource conditions and maintain infrastructure.

FW-ATRISK-MA-1 Work collaboratively with other agencies (e.g., USFWS, NMDGF, New Mexico State Forestry, etc.), universities, and nongovernmental organizations for the research and management of at risk species. Emphasis is placed on the protection and restoration of key habitats and habitat features that lead to their recovery and persistence.

Analysis of Effects:
This program area could reduce impacts to JMS and its habitat, although monitoring or habitat assessments could result in short term disturbance impacts to JMS and possibly some limited trampling of prey habitat. At-risk species that are not exposed to unnatural disease spread or are treated for known pathogens will have increase survival over exposed or untreated. While guidelines could limit project or

activity impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* JMS and its habitat.

Effects of Energy, Minerals, and Caves

This program area has the potential through land or facility development or activities to impact NMMJM, often through disturbance and loss/fragmentation of habitat. Effects from the activities of this program are similar to the effects of roads. Access roads and the accompanying vehicle traffic and use of heavy equipment are often associated with mineral activities. In addition, surface occupancy causes direct habitat loss and the addition of human occupation increases the chances for harassment and lethal encounters.

FW-LEASEMIN-DC-1 Surface resource impacts resulting from energy mineral development do not have adverse long-term effects on ecosystem health or watershed conditions.

FW-MINERAL-S-2 In mineral sites exceeding 5 acres, mined-out areas must be stabilized or reclaimed as new mine areas are opened.

FW-LANDSU-DC-3 Authorized roads, utilities, and communications sites and corridors have minimal impacts on natural resources.

FW-LANDSU-S-1 Permits for utilities that require use of roads not listed on the MVUM must incorporate requirements for road construction, reconstruction, or maintenance.

Effects of Designated Areas, Management Areas and Geographic Areas

MA-OGLEASE-DC-1 Oil and gas activities meet the legal mandates to facilitate the development of minerals in a manner that minimizes adverse impacts to surface and groundwater resources, watershed and forest ecosystem health, wildlife and wildlife habitat, scenic character, and other desired conditions applicable to the area.

DA-ALLDA-G-1 Within designated areas, footprints of ground-disturbing fire-suppression activities should be as small as possible or located where ground disturbance has previously occurred.

DA-RNA-S-6 New roads must not be constructed and closed roads must not be opened.

DA-RNA-S-8 New utility corridors must not be permitted or authorized.

DA-WSR-G-2 Within scenic sections of the East Fork of the Jemez, the river should:

a. remain free of impoundments;

b. have largely primitive shorelines and shoreline development; and

c. Be accessible by roads only at certain points.

The Jemez Mesas and Canyons Geographic Area predominantly contains MCD (38 percent), and PPF (35 percent) ecosystems. The designated areas: Monument Canyon Research Natural Area and the Dome Wilderness lie within the area's boundary, while Bandelier National Monument and the Valles Caldera National Preserve are located nearby. The Jemez River, a tributary of the Rio Grande, also flows through this area. The forests here are home to threatened and endangered species including the New Mexico jumping mouse, Jemez Mountain salamander, and the Mexican spotted owl. This geographic area has

desired conditions for healthy and productive ecosystems, and for protecting water quality and availability.

Analysis of Effects:
Guidelines to decrease the footprint of ground disturbing activities can be found in multiple plan components throughout a variety of resources including Riparian Management Zones, At-risk Species, Soils, Forestry, Roads, Special Uses, and Minerals. Common verbiage includes, "footprints of ground-disturbing activities should be as small as possible or located where ground disturbance has previously occurred." Under the proposed action, temporary roads that support ecosystem restoration activities, fuels management, or other short-term projects should be closed, decommissioned, or obliterated (restored to more natural vegetative conditions) upon project completion to protect watershed condition, minimize wildlife disturbance, and prevent illegal motorized use. There are also objectives to mitigate ecological damage at developed recreation sites every three years. However, actions associated with these protection measures may have short term impacts to JMS and its habitat.

Effects on Critical Habitat and Primary Constituent Elements

Effects to JMS recovery and protected habitat discussed above would apply to critical habitat for this species. Table 14 shows which program areas may impact specific critical habitat PCEs in either a positive or negative manner. It is important to note that LMP implementation would not necessarily have these impacts across all critical habitat for the JMS on the Santa Fe NF.

Table 14. The PCEs for Jemez Mountains salamander designated critical habitat

Program Area	Affected PCEs (by number) and Principle Mechanism
Wildland Fire Management	1, and 3. Potential to reduce uncharacteristic wildfire; also prescribed burning potential to reduce snags, woody species regeneration, canopy cover, and herbaceous prey habitat.
Ecosystem/Vegetation Health (Forest Products)	
Watershed and Soil Management (Riparian Areas)	1 and 3. Impacts to soil and vegetation during treatments.
Engineering	1, and 3. Road building or maintenance impacts to habitat (woody and herbaceous vegetation).
Lands and Minerals (Special Uses)	1 and 3. Some site specific impacts to forest structure.
Recreation and Wilderness	1, 3 and 4. Recreation vehicle and foot impacts to riparian vegetation and disturbance of ground litter and woody debris.
Wildlife, Fish, and Rare Plants	4. Potential for limited short term impacts from trampling of prey habitat during monitoring or habitat assessments.

PCE 1 Forest structure
All program areas are likely to impact regeneration of woody species and herbaceous plant prey habitat. Most are likely to impact forest canopy cover and snag persistence through burning or thinning to some level.

PCE 3 Canyon habitat components
Some program areas are likely to impact the tree density that supports the cool microclimate needed to sustain JMS in canyon habitat; these are also likely to impact ground litter and woody debris.

PCE 4 Underground habitat in Forest or Meadow

Potential for limited short term impacts from trampling of prey habitat during monitoring or habitat assessments.

Overall, essentially all program areas are likely to have some negative impacts to JMS primary constituent elements of critical habitat. However, it is important to note that LMP implementation would not necessarily have these impacts across all critical habitat for the JMS on the Santa Fe NF.

Cumulative Effects and Climate Change

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area of impacts for a listed species. Timber harvest, prescribed burning activities, and livestock grazing occur on the adjacent nonfederal lands. The implications for JMS of climate change and variability with greater extremes of temperature and moisture could include declining acreage of forested habitat, greater risk of insect and disease impacts to habitat, and greater risk of stand-replacing wildfire.

Summary and Determination of Effects

Overall LMP direction is to maintain or restore desired conditions for forest, woodland, and riparian forest PNVTs needed to support JMS. It has the potential to help stabilize riparian areas and improve riparian composition, structure, and function where road removal and restoration projects occur within JMS recovery habitat.

Summary

Vegetation Management

Mechanical harvest and thinning vegetation treatments use heavy equipment such as forwarders, skid-steers, and feller-bunchers. Potential effects, both positive and negative, from mechanical harvest and thinning are listed below.

- Removing and thinning woody species encroachment will help restore desired vegetation species composition and structure in Riparian Management Zones, returning riparian areas toward desired conditions and contributing to more natural hydrologic cycles and functions.
- Heavy equipment use in sensitive riparian areas can trample individuals, compact and rut the soil. Rutted soil is likely to channelize water, making it more susceptible to erosion and entrainment (Elliot et al. 2010); compacted soils have reduced infiltration, resist revegetation, and have increased erosion. The increase in erosion from channelized runoff and compacted surfaces will lead to degraded riparian hydrologic function and increase sedimentation into streams.
- Removing and thinning encroaching woody species from Riparian Management Zones, particularly from HERB and CWG ERUs may increase hydrologic connectivity between riparian areas and streams by increasing shallow subsurface flow available to replenish streams (Huxman et al 2005, Scott et al 2006).

Restoration Activities

Stream channel and riparian restoration actions include a suite of possible activities that all should have the beneficial effect of rehabilitated geomorphic and biological processes, which would help to restore stream and riparian ecosystem services. Restoration actions will ensure that streams and riparian areas are properly functioning, which provide clean water, regulated water temperature, water storage, sediment storage, nutrient cycling and good habitat (Gregory et al. 1991).

- Heavy equipment use for any restoration action including road decommissioning will increase ground disturbance and may increase erosion causing sedimentation through the riparian area into the adjacent waterway. Sediment and turbidity adversely affect water quality, aquatic habitat, and flood capacity by making water more difficult to clean, decreasing the oxygen supply to fish and amphibians, decreasing habitat diversity and availability, as well as decreasing channel volume (Henley et al. 2000; Postel and Thompson 2005).

Road Decommissioning

Road decommissioning is a common restoration practice which involves using heavy equipment to treat the road prism to reduce erosion and hydrologic impact. Levels of treatment range widely, but generally requires decompacting the road and may involve removing the road prism and reshaping the area to match natural hillslope contours.

- Road decommissioning should benefit surface water resources and Riparian Management Zones through restored hillslope drainage patterns, increased infiltration, increasing water storage and retention, restored hydrographs, decreased channel aggradation, and improved water quality.

- Reducing road system mileages may limit motorized use impacts in RMZ including the spread of invasive plants and increases in erosion. Ultimately, these should result in a water supply that is less expensive to clean to standard, increased baseflows during the dry periods of the year, and improved fisheries.

- Heavy equipment is often used to accomplish restoration, thereby disturbing the ground within or adjacent to flowing water. Ground disturbance dislodges soil, making it easier to erode and entrain, thereby, introducing sediment and turbidity to the waterbody. Further, restoration activities may temporarily alter stream shade by removing vegetation during work.

- Invasive species (noxious weed) removal and treatment includes both hand (pulling weeds) and chemical treatment (applying herbicides).

- As one of the major limiting factors in properly functioning condition (PFC) of Riparian Management Zones, removal of invasive species should help promote recovery of vegetation species and composition and PFC of Riparian Management Zones.

- Use of chemical application can adversely affect water quality when sediment or chemicals are delivered to a water body through the riparian area. Longer than predicted residence times of herbicide in soils are not uncommon, and as the herbicide remains in the soil it can inhibit the recovery of native vegetation.

Because the salamander has permeable skin, and respiration occurs through the skin and physiological functions are carried out with its skin, it may be susceptible if it comes in contact with fire retardants or herbicides

Restoration by wildfire and prescribed fire

- Fire may reduce encroachment of woody species where the densities of woody species is outside the range of natural variability for riparian ERUs in the Santa Fe NF, encouraging the return of natural fire regimes and restoring native ground cover.

- Fire may cause adverse effects to Riparian Management Zones if fire severities cause super-heating of the soil. High heat not only removes groundcover, but can cause soil hydrophobicity by which water is repelled from soil pores (DeBano et al. 1976). In large areas of hydrophobicity, excessive runoff is generated because infiltration is significantly reduced (DeBano 1971). Excessive runoff can result in flashier hydrographs (Moody and Martin 2001) as well as erosion and sedimentation (Certini 2005), both of which adversely affect water quality and aquatic habitat. In some cases, high severity fire in riparian areas could cause heating of the soil to temperatures high enough to kill both existing vegetation and the native seeds and volatize available nutrients in the soil, in these cases natural recovery potential could be retarded and the riparian areas left more vulnerable to invasion by nonnative species, which thrive after disturbances and are well adapted to nutrient poor soils.

Dispersed recreation

Dispersed recreation areas can be detrimental to riparian areas where human use concentrates in riparian areas adjacent to streams and wetland features. Detrimental effects intensify if sites are accessed by motorized vehicle.

- Concentrated human use can destabilize soils by foot and vehicle traffic damaging aquatic habitat and water quality through loss of vegetation and increased sedimentation. Water quality can be further degraded by human waste, fuel (for stoves, ATVs, etc.), and other contaminants that are introduced to waterbodies. Restoring dispersed sites can have the long term positive impacts on vegetation and water quality and have short-term negative impacts.

- Dispersed sites that are merely closed and not actively rehabilitated will not experience the short-term impacts from heavy equipment use in riparian areas but also will not likely improve or recover completely on their own. Sites will remain compacted from years of vehicle traffic; the compaction will inhibit revegetation leaving exposed soils and vulnerabilities to invasive plant encroachment. The compacted bare ground will prevent infiltration of precipitation, which will cause continued runoff and erosion degrading water quality.

Determination of Effects

Standards and guidelines are designed to limit the extent, level, and duration of potential short term effects; however, LMP implementation does not provide for mitigation of all potential effects to a level that can be equated to or considered insignificant and/or discountable. Therefore, LMP implementation *may affect and is likely to adversely affect* the Jemez Mountain Salamander and it *may affect and is likely to adversely affect* critical habitat for the species.

Holy Ghost Ipomopsis (*Ipomopsis sancti-spiritus*)

- Endangered Species Act Status: Endangered
- Recovery Plan, First Revision: Original Recovery Plan Approved September 26, 2002, Recovery Plan Amendment (Objectives and Criteria) Approved August 28, 2019
- Critical Habitat: No Critical Habitat Designated or Proposed
- District Occurrence: Endemic to one canyon in Sangre de Cristo Mountains.
- Determination of Effects (species): ***May affect and is likely to adversely affect***

- Determination Effects (critical habitat): **Not Applicable** ***for designated CH but may affect and is likely to adversely affect habitat***

Status of Species and Habitat

Legal Status and Description

Holy Ghost ipomosis is a federally and New Mexico state-listed endangered species narrowly endemic to a single canyon in San Miguel County. The Recovery Plan (USFWS 2002) indicates that there are no obviously unique habitat characteristics that would explain the restriction distribution of the species.

The 2008 five year review of Holy Ghost Ipomopsis states that, "Peripheral colonies are poorly documented in Holy Ghost Canyon but have been found in forest openings and areas recently disturbed through human activity. Some of these areas, occupied in 1999, no longer support Holy Ghost ipomopsis. Peripheral colonies are likely critical to the recovery of Holy Ghost ipomopsis but their persistence may depend on adopting new management practices to simulate natural disturbance in Holy Ghost Canyon. Like many other members in the same genus, Holy Ghost ipomopsis is disturbance-adapted, occupying early successional sites in ponderosa pine and mixed-conifer forest."

Life History and Habitat

Holy Ghost ipomopsis is a biennial to short-lived, monocarpic perennial herb in the phlox family with pink flowers that typically grows between 30 to 80 centimeters (12 to 31 in) tall (Wilken and Fletcher 1988). Monocarpic species only flower once before dying. Roth (2018) indicates that the species lives from 2-5 years. The plant most often grows on steep, west-facing limestone slopes with plants concentrated along a roadside. It occurs in openings in ponderosa pine-Douglas fir forest, and appears to have an affinity to open disturbed areas with little competition from other perennials (Roth 2018).

Distribution, Abundance, and Trend

Status of the Species within the Action Area

The only known naturally occurring population of Holy Ghost ipomosis is limited to Holy Ghost Canyon in the Santa Fe National Forest. In addition, there are currently five experimental out-planting locations within the Holy Ghost Canyon, Winsor Creek, Panchuela Creek, and Indian Creek drainages on Santa Fe National Forest lands.

Threats

The Recovery Plan (USFWS 2002) states that "potential immediate threats to this species include small population size, road maintenance, recreation impacts, and catastrophic forest fire. In the long term, preventing natural disturbances that result from events like wildfire reduces the number of early successional sites for this species."

The Final Recovery Plan Amendment for Holy Ghost ipomopsis (USFWS 2019) updates the risks by stating, "Emerging threats since the time of listing include an increased forest canopy leading to high risk of catastrophic fire, the influx of invasive plants, and potential effects of climate change (e.g., increasing temperatures, increased periods of drought, habitat drying, etc.) (USFWS 2008). Therefore, the threats to this increasingly narrow endemic species have increased since time of listing and since the 2002 Holy Ghost Ipomopsis Recovery Plan was published."

Status of the Species and Habitat in the Action Area

Status of the Species with the Action Area

Ongoing monitoring has continued for this species has occurred from 2003, and is summarized in the Final Recovery Plan Amendment for Holy Ghost Ipomopsis (USFWS 2019) as, "From 2003-2008, an average of 703 total plants were counted per year. From 2008-2012, an average number of 484 total plants were counted per year, indicating a downward population trend. From 2013-2017, an average of 593 total plants were counted per year (Roth 2015a). While numbers since 2012 appear to be increasing, the population remains below the average number of plants used for the most recent 5-year review (n=703) (USFWS 2008). There is evidence that the species is in a declining trend. The comparison of population wide census results from 2008 and 2015 seem to point at an increase in overall population size. However, the 2015 survey effort was longer, the spring was much wetter and about half of the plants were counted from plantings for the 2 Holy Ghost Canyon Treatment plots in 2011. These factors make it uncertain whether a true change was seen between the survey years and make comparison between the two census efforts difficult (Roth 2018).

Status of the Habitat with the Action Area

Critical habitat has not been designated or proposed for this species.

Conservation Measures: Conservation Actions 7 (a)(1)

No specific conservation actions have been implemented for the Mexican Spotted Owl on the Santa Fe; however, a Forest Plan guideline requires that project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan. The proposed action also includes management approaches for at-risk species. These would further help to provide persistence for the mouse throughout its range by promoting collaborative partnerships to aid in recovery and delisting and to consider habitat fragmentation on adjacent lands when planning activities on the Santa Fe. They include the following:

Management Approaches (FW-ATRISK-MA-1 and FWATRISK-MA-2)

Effects Analysis for Holy Ghost ipomopsis

In the individual program area discussions below, the implication of relevant desired conditions to Holy Ghost ipomopsis are noted. Potential impacts of each objective, standard, and guideline to the species and habitat are described. Where applicable, management areas are addressed. A determination of effects is then made for that program area. Subsequent to all program areas, an overall determination of effects for this species from LMP implementation is provided in the Summary of Effects and Determinations section for Holy Ghost ipomopsis. The species is restricted to a single canyon, but its habitat is not unique. The effects discussion is based on the effects of LMP implementation to the general health of the habitat for Holy Ghost ipomopsis on a forest wide basis in addition to the narrow band of currently occupied habitat. For some program areas the analysis considers program activities within a five mile buffer of the proposed Holy Ghost Canyon management area. While this area is not considered in Alternative 2 it focuses analysis on suitable habitat with the highest likelihood of being occupied.

Effects of Frequent Fires and Grass Cover

There are 12 relevant desired conditions that guide management and activities here (see Table 9). Desired conditions in ALL FW-VEG-DC, and FW-WUI-DC 2 and 3 and FW-FIRE-DC 2 and 3 directs management toward activities and conditions where fire is again able to play its historic role in

maintaining fire adapted ecosystems; this would reduce the threat of stand-replacing or uncharacteristic wildfire to Holy Ghost ipomopsis and habitat.

Desired conditions within the proposed action explicitly defines the percentage of seral states in each forested ERU (i.e. early, mid-, and late-) (ALL FW-PPF-DCs, ALL FW-MCD-DCS) They also provide guidance on tree size class, vegetation structure, fire return interval, dominant understory vegetative species types, as well as specific ecological conditions indicative of a healthy ecosystem. The proposed action sets a maximum objective within MCD and PPF of 280,000 to 350,000 acres of restoration work to be completed respectively, over a 10-year period. The desired conditions in the proposed action calls for 72 percent of MCD to be open canopy. The objectives, standards, and guidelines in the proposed action would reduce this risk of catastrophic fire by moving toward desired conditions which call for 86 percent of PPF to be open canopy. This would improve seral state and reduce the likelihood that uncharacteristic fire would negatively impact on Holy Ghost ipomopsis. Additionally, Holy Ghost ipomopsis is an early seral species, so creating more early seral habitat would be good for the species.

Desired conditions within the proposed action also address fire and its effects on Holy Ghost ipomopsis habitat (FW-WUI-DC-1-3, FW-FIRE-DC-1-6) within the general forest and the Wildland Urban Interface.

FW-WUI-DC-1 Wildland fires in the WUI do not result in the loss of life, property, or characteristic ecosystem function.

FW-WUI-DC-2 Wildland fires in the WUI are low to moderate intensity surface fires. Firefighters are able to safely and efficiently suppress wildfires in the WUI using direct attack.

FW-WUI-DC-3 Ecosystem structure promotes low-intensity surface fires in areas where the WUI intersects vegetation types with a mixed- or high-severity fire regimes (e.g., SFF and MCW).

a) Tree basal area reflects the low end of the range within the desired conditions for individual vegetation types.

b) Ladder fuels are nearly absent.

c) Openings between tree groups are of sufficient size to discourage isolated group torching from spreading as a crown fire to other groups. Trees within groups may be more widely spaced with less interlocking of the crowns than desirable in adjacent forest lands. Openings with grass/forb/shrub vegetation occupy the mid to upper end of the percentage range in the desired conditions.

FW-FIRE-DC-1 Wildland fires do not result in the loss of life, property, or cultural resources, or create irreparable harm to ecological resources.

FW-FIRE-DC-2 Wildland fire protects, maintains, and enhances resources. It is allowed to function in its natural ecological role on a landscape scale and across administrative boundaries, under conditions where safety and values at risk can be protected.

FW-FIRE-DC-3 Wildland fires burn within the range of severity and frequency of historic fire regimes for the affected vegetation communities. High-severity fires rarely occur where they were not historically part of the fire regime.

FW-FIRE-DC-4 naturally caused fires predominate; accidental human-caused fires (e.g., abandoned campfire, downed powerlines) are rare.

FW-FIRE-DC-5 Fires function in their natural ecological role in designated areas (e.g., wilderness and research natural areas).

FW-FIRE-DC-6 Restoration and fuel treatments result in ecological resources that are adaptable to changing climate conditions.

FW-FORESTRY-DC-4 Non-commercial and commercial timber harvest supplement restoration and maintenance treatments at a scale that achieves landscape desired conditions and contribute to watershed restoration function and resilience, wildlife habitat enhancement, small and large business and employment opportunities, and provide wood products.

FW-FORESTRY-DC-5 Harvest of dead and dying trees for economic value is consistent with the desired conditions of wildlife habitat, soil productivity, and ecosystem functions.

FW-VEG-MA-1 Consider management actions that replicate natural disturbance regimes.

FW-VEG-O-1 Over a 10-year period, complete at least the following treatments to move vegetation resources toward desired conditions:

Vegetation ERU	Mechanical Treatment (acres)	Prescribed Fire and Naturally Ignited Wildfire (acres)
Mixed Conifer with Frequent Fire (MCD)	10,000–80,000	50,000–200,000
Ponderosa Pine (PPF)	15,000–100,000	150,000–250,000

FW-VEG-O-2 Over a 10-year period, complete 2,500 to 50,000 acres of combined vegetation treatments in highly departed non-forested ERUs to move vegetation toward desired conditions (i.e., restoration). Treatments may include mechanical treatments, prescribed fire or naturally ignited wildfires, seeding, or other techniques still to be determined by best available science depending on the specific ERU. Highly departed non-forested ERUs are juniper grass (JUG), piñon juniper grass (PJG), Colorado Plateau Great Basin grassland (CPGB), sagebrush shrubland (SAGE), and montane subalpine grassland (MSG).

FW-VEG-G-1 1Management activities should favor the retention of species that naturally occurred in those ecosystems. Native species should be present in the relative proportions characteristic of those ecosystems.

FW-FIRE-G-1 Naturally occurring fires should be allowed to perform their natural ecological role to meet multiple resource objectives and facilitate progress toward desired conditions (per desired conditions of various resources throughout the plan).

FW-FIRE-G-8 Post-fire restoration and recovery should be provided where critical resource concerns merit rehabilitation for controlling the spread of invasive species, protecting areas of cultural concern, protecting critical or endangered species habitat, or protecting other highly valued resources such as drinking water.

FW-FIRE-G-9 Higher fire intensities and associated fire effects at the fine scale (less than 10 acres) should be accepted in areas that are moderately to highly departed from desired conditions. Multiple small areas of high mortality are preferable to a single large, high-severity area.

FW-FIRE-G-10 Burn pile composition should contain a mixture of fuel sizes. Large woody fuels, 9 inches in diameter or greater, should be limited to less than 40 percent of the composition of the pile to prevent adverse impacts to the soil.

FW-FIRE-G-11 Depth of masticated materials should not exceed an average of 4 inches and materials should be discontinuous at the quarter-acre scale to protect the soil and allow for natural revegetation.

FW-FIRE-MA-6 Consider the use of planned and unplanned fire in areas such as steep and rugged terrain or remote areas, as this may be the only viable tool where mechanical treatments are not feasible.

FW-FIRE-MA-7 Consider implementing treatments where they provide the most benefit (e.g., values-at-risk) and improve or maintain ecological integrity (e.g., vegetative departure).

FW-FIRE-MA-8 When managing planned ignitions, consider creating conditions that enable future unplanned ignitions to mimic their historical role or to serve as a tool to achieve resource objectives and to move ecosystems closer to desired conditions.

FW-FIRE-MA-9 In areas departed or trending away from desired conditions, consider combining the use of fire with mechanical treatments, as this is often the most effective approach to restoring forest structure and function.

FW-FIRE-MA-12 Consider the scenic effects from prescribed fire during project planning and implementation. Blackened and scorched vegetation may be visible in project areas in the short term following treatments, but take into consideration the long-term scenic integrity objectives.

FW-FIRE-MA-14 Consider collaborating with scientists (e.g., from universities, Forest Service Research and Development, U.S. Geological Survey, or Ecological Restoration Institute) to conduct research on areas impacted by uncharacteristic wildfire to understand how fire has altered the ecological conditions outside the natural range of variation and develop strategies to better manage these areas.

FW-FORESTRY-S-1 Regulated timber harvest (tree harvest for the purposes of timber production) must occur only on lands classified as suitable for timber production (16 U.S.C. 1604).

a) On lands suitable for timber production, timber harvest intended to create openings for tree regeneration must only be used when there is reasonable assurance of restocking within 5 years after final regeneration harvest.

b) Timber harvest would occur only where soil, slope, or watershed conditions would not be irreversibly damaged.

c) Timber will be harvested only where protection is provided for streams, streambanks, shorelines, lakes, wetlands, and other bodies of water.

d) Timber harvest will be carried out consistent with the protection of soil, watershed, fish, wildlife, traditional use resources, cultural and historic resources, recreation, and aesthetic resources.

e) Timber will be harvested only where the harvesting system is not selected primarily because it will give the greatest dollar return or unit output of timber.

FW-FORESTRY-G-1 On suitable timberlands, regeneration harvest of even-aged stands should have reached or surpassed 95 percent of the culmination of mean annual increment, unless it is needed to:

a) Reduce fire hazard within the wildland-urban interface (WUI),

b) Contribute toward achieving the desired uneven-aged vegetation conditions over the long term, or

c) Treats unsustainable stand conditions resulting from insects, disease, or other damage agents.

FW-FORESTRY-G-2 Log landing areas should be located outside of mapped sensitive areas (e.g., riparian management zones, wetlands, archeological sites, threatened and endangered critical habitat, and along Scenery Management System Concern Level I Routes). When landings must be located in these areas, effects to the sensitive resource will be mitigated.

FW-FORESTRY-MA-5 In addition to treatments in highly departed frequent fire ERUs (e.g., PPF, MCD), consider treatments within infrequent-fire ERUs (e.g., spruce-fir forest, mixed conifer with aspen, and piñon-juniper woodland) for ecological and socioeconomic benefits.

Analysis of Effects:
Treatments to return Holy Ghost ipomopsis habitat back to reference condition will beneficially effect the species on the whole. The guidelines above provide for management to frequent fire forest communities with short term impacts to habitat while providing an overall benefit to the habitat types that Holy Ghost ipomopsis resides in. The occupied habitat in Holy Ghost Canyon and the associated outplanting sites continues is subject to canopy encroachment and provides little of the early seral habitat needed by the species.

Numerous factors within the five-mile buffer of the proposed Holy Ghost Canyon management area make long term restoration of the fire regime in the area difficult. Approximately 31 percent of the area is wilderness, 24 percent is inventoried roadless area and 10 percent is private property. Thinning within occupied habitat would likely need to be more restrictive than the current guidelines. Handthinning within the immediate vicinity of occupied habitat could have the least short-term impacts while providing long term benefits. A small disturbance plot to track survival rates of transplanted plants in thinned and unthinned plots has proven inconclusive.

The Tres Lagunas fire burned to the edge of occupied habitat in 2013 (Roth 2018) and burned approximately 13 percent of the five mile buffer of the proposed Holy Ghost Canyon management area. None of the plants or their habitat in Holy Ghost Canyon or Indian Creek were impacted by the fire, firefighting activities, or post-fire clean-up (Roth 2018). In 2016, suitable habitat was surveyed in areas that were burned by the Tres Lagunas fire with special emphasis on roadcuts with the appropriate limestone substrate, but no new populations were found. Approximately 16 percent of the five-mile buffer of the proposed Holy Ghost Canyon management area is Wildland Urban Interface. The Holy Ghost WUI covers most of the occupied suitable habitat for Holy Ghost ipomopsis. Implementation of fuels treatments within these WUI's (Holy Ghost, Pecos Canyon Corridor, Windsor Canyon, Grass Mountain, Power Line and Hyde Park Corridor) would increase the resiliency of Holy Ghost ipomopsis and its habitat to the effects of fire. While guidelines could help limit the impacts from this program area, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* Holy Ghost ipomopsis and its habitat.

Effects of Watershed and Soil Management

FW-RWE-DC-4 Riparian areas and wetland ecosystems meet the standards defined by proper functioning condition metrics (e.g., Prichard et al. 1998). RE and WE are supported by surface and subsurface flow regimes that contribute to stream-channel and floodplain development, maintenance, and function; which

maintain soil moisture necessary for the regeneration of native plants that depend on flooding or high water tables.

a) Stream channels, riparian areas, and wetland ecosystems are resilient to ecological disturbances (e.g., floods, fire, drought, and changes in climate) and human activities (e.g., roads, livestock, and recreation).

b) RE and WE are widening or have achieved potential extent and are within their natural range of variability.

c) Overall wetland condition score of 'A' or 'B' or equivalent rating for proper functioning condition (sensu Prichard et al. 2003)

FW-RWE-O-1 Riparian ecosystems move toward desired conditions (less than a 33 percent departure from DC) for vegetation functional diversity, vegetation seral state, riparian corridor connectivity, and flood regime (frequency, duration, and magnitude) by implementing 15 miles of stream every 10 years.

FW-RWE-S-1 Ground-disturbing activities within riparian areas and wetland ecosystems must take measures to avoid introducing new or spreading existing invasive species and pathogens (per Standard 1 in Wildlife: Nonnative and Invasive Species).

FW-RWE-G-2 Within RMZs, management activities (e.g., recreation, permitted uses, structural developments such as livestock water gaps, pipelines, or other infrastructure) should occur at levels or scales that move toward desired conditions for water, soils, aquatic species habitat, and vegetation within the sub-watershed in which the management activity is taking place. Activities and facilities with a small footprint (e.g., access points, intermittent livestock crossing locations, water gaps, or other infrastructure) may be necessary to manage larger scale impacts within the RMZ, recognizing there may be trade-offs between activities and resources.

FW-RWE-G-7 Herbivory of riparian plants should not cause long-term trends away from desired riparian conditions.

FW-SOIL-G-1 Ground-disturbing management activities should be designed to minimize short- and long-term adverse impacts to soil resources (e.g., soil compaction and soil loss). Where disturbance cannot be avoided, project-specific soil and water conservation practices should be developed. When soil conditions are less than satisfactory as a result of management activities, restoration of soil condition should occur.

FW-SOIL-G-2 During forest management activities such as thinning and prescribed fire, large woody material should be retained to meet desired conditions relevant to the ERU to support nutrient cycling.

Analysis of Effects:
The plant most often grows on steep, west-facing limestone slopes with plants concentrated along a roadside. Standards and guidelines for managing soil and watershed are relevant to management of the species habitat. Riparian management zone standards (FW-RMZ-S-1) would help reduce the spread of invasive species, resulting in less competition for space and resources with these species. Riparian management zone guidelines (FW-RMZ-G-2 and 7) would maintain overall riparian health. Soil guidelines (FW-SOIL-G-1 and 2) would reduce the risk of introduction of nonnative invasive species and maintain soil. While standards and guidelines could limit impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* Holy Ghost ipomopsis and its habitat.

Effects of Infrastructures, Roads and Trails

The desired condition for roads (FW-ROADS-DC-3) helps maintain healthy watercourses. Holy Ghost ipomosis is situated between Holy Ghost and Doctor Creeks. Not adversely affecting these habitats maintains the overall habitat health for Holy Ghost ipomosis.

FW-ROADS-DC-3 Roads do not adversely affect watercourses or sensitive riparian areas.

FW-ROADS-G-7 Reconstruction and rehabilitation of existing roads should be emphasized over new road construction.

FW-ROADS-G-8 Temporary roads (e.g., that support ecosystem restoration activities, fuels management, or other short-term projects) should be closed and rehabilitated (restored to more natural vegetative conditions) upon project completion to protect watershed condition, minimize wildlife disturbance, and prevent illegal motorized use.

FW-ROADS-G-9 Construction of new roads and trails or reconstruction and maintenance of existing roads intersecting fish-bearing streams should accommodate aquatic organism passage.

FW-ROADS-G-10 If at-risk species are present and will be impacted by road construction or maintenance activities, work should be conducted to avoid or minimize noise and habitat disturbance and outside of critical life-cycle periods (e.g., breeding or nesting for birds) or when animals may not be present (e.g., during migration).

Analysis of Effects:
Holy Ghost ipomopsis is still largely confined to steep open roadsides along Santa Fe NF Road 122. The desired conditions and guidelines for roads reduce the impacts associated with these activities, but the species remains vulnerable to impacts from road use, road management, road improvement and road maintenance. Impacts from these activities could include being ran over, being destroyed during road maintenance, ditch cleanout or road widening. While standards and guidelines could limit impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* Holy Ghost ipomopsis and its habitat.

Effects of Wildlife, Fish, and Plants

The desired conditions, objectives and management approaches that guide management for terrestrial species and habitat provide for improvement of Holy Ghost ipomopsis habitat. The desired conditions and management approach for at-risk species direct management toward the recovery of Holy Ghost ipomopsis.

FW-TERRASH-DC-1 Terrestrial ecosystems are composed of appropriate (native) assemblages of sustainable populations of plant and animal species that are supported by healthy ecosystems.

a) A diversity of habitat components, including biotic and abiotic features, are available at the appropriate spatial, temporal, compositional, and structural levels (as defined by Desired Conditions for each Vegetation ERU) to provide adequate opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so that forest species remain viable and persistent on the landscape.

b) Undesired nonnative and invasive terrestrial species, as well as introduced pathogens, are rare or absent (per Desired Condition 1 in Wildlife: Nonnative and Invasive Species).

c) Terrestrial habitats allow for the maintenance and promotion of interspecific relationships at all trophic levels (e.g., producer-consumer and predator-prey relationships) across multiple scales, consistent with existing landforms and topography.

FW-TERRASH-DC-2 Habitat configuration, connectivity, and availability allow wildlife populations to adjust their movements in response to major disturbances (e.g., climate change or uncharacteristic fire) and promote genetic flow between wildlife populations.

FW-TERRASH-O-2 Restore or enhance at least 50,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan. This may be done in conjunction with objectives for treatments in the vegetation section.

FW-TERRASH-MA-1 Work collaboratively with the New Mexico Department of Game and Fish and other organizations, government institutions (local, State, Tribal, and Federal), individuals, and groups to plan and implement projects for the management and research of wildlife and their habitats, including Rocky Mountain bighorn sheep.

FW-ATRISK-DC-1 Ecological conditions (physical and biotic) contribute to the survival and recovery of federally listed, proposed, and candidate species; preclude the need for listing new species; and allow for the recovery and persistence of species of conservation concern.

FW-ATRISK-DC- 2 Intact, functioning, and sufficient habitat for terrestrial and aquatic at-risk species (defined by Desired Conditions for each Vegetation ERU) provide for opportunity for breeding, feeding, nesting, and other critical life history needs of wildlife, so the species remains viable and persistent on the landscape.

FW-ATRISK-DC- 3 Habitats for at-risk species, including rare and endemic populations, are known (locations) to be intact, functioning, well-connected, and sufficient for species' persistence.

FW-ATRISK-G-1 All authorized activities should be designed and implemented to address threats to at-risk species and their habitats, including, but not limited to:

a) Timing restrictions to encourage reproductive success;

b) Prevention of introduction of invasive, competing, or predatory species (these are species directly and negatively impacting at-risk species populations);

c) Prevention or introduction of pathogens leading to population impacts;

d) Creation or removal of obstructions that may alter natural migration or directly cause mortality to wildlife; and

e) Avoiding or protecting small or isolated populations.

FW-ATRISK-G-2 Project activities and special uses occurring within federally designated critical habitat should integrate habitat management objectives and species protection measures from the most recent approved U.S. Fish and Wildlife Service (USFWS) recovery plan.

FW-ATRISK-MA-1 Work collaboratively with other agencies (e.g., USFWS, NMDGF, New Mexico State Forestry, etc.), universities, and nongovernmental organizations for the research and management of at risk species. Emphasis is placed on the protection and restoration of key habitats and habitat features that lead to their recovery and persistence.

Analysis of Effects:
The guidelines for the Wildlife, Fish and Plants program area can reduce some impacts to Holy Ghost ipomopsis. The activities from this program are unlikely to have impacts that are high enough in magnitude, intensity and duration to have negative impacts with the exception of restoration or enhancement of terrestrial wildlife habitat. Activities and guidelines in this program area likely to benefit include those for nonnative invasive species. Smooth brome (*Bromus inermis*) and Kentucky bluegrass (*Poa pratensis*) are spreading within occupied habitat, resulting in the sod bound areas that exclude Holy Ghost ipomopsis (USFWS 2008). While guidelines could limit project or activity impacts, not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* Holy Ghost ipomopsis and its habitat.

Effects of Energy, Minerals, and Caves

Utility line maintenance remains one of the threats to Holy Ghost ipomopsis since these activities can result in direct disturbance to individual plants. Design criteria (FW-LANDSSU-DC-3) and standard (FW-LANDSSU-S-2) could limit impacts, but not all negative impacts would be reduced or eliminated. The Holy Ghost ipomopsis occurs in an area with high mineral potential. The former Tererro mine is near the occupied habitat for the species, and there is recent interest in new mineral exploration south of the occupied habitat in the Jones Hill area. Within the five mile buffer of the proposed Holy Ghost Canyon management area approximately 11 percent is listed as having high known mineral potential. Nearly all of the occupied site from the natural population has high known mineral potential. Mineral extraction within occupied habitat can result in the loss of individual plants and alteration of habitat to the point of no longer being suitable. Design criteria (FW-LEASEMIN-DC-1) and standard (FW-MINERAL-S-2) could limit some impacts, but not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* Holy Ghost ipomopsis and its habitat.

FW-LANDSU-DC-3 Authorized roads, utilities, and communications sites and corridors have minimal impacts on natural resources.

FW-LANDSU-G-2 To minimize the potential hazards associated with diesel-powered generators, propane generators or renewable energy sources should be used at facilities operating under a lands special-use permit that require onsite power generation.

FW-LEASEMIN-DC-1 Surface resource impacts resulting from energy mineral development do not have adverse long-term effects on ecosystem health or watershed conditions.

FW-MINERAL-S-2 In mineral sites exceeding 5 acres, mined-out areas must be stabilized or reclaimed as new mine areas are opened.

Effects of Designated Areas, Management Areas and Geographic Areas

Design criteria for this program area would guide these program areas to reduce impacts from oil and gas activities (MA-OGLEASE-DC-1) and for a population of Holy Ghost ipomopsis heading toward recovery.

MA-OGLEASE-DC-1 Oil and gas activities meet the legal mandates to facilitate the development of minerals in a manner that minimizes adverse impacts to surface and groundwater resources, watershed and forest ecosystem health, wildlife and wildlife habitat, scenic character, and other desired conditions applicable to the area.

GA-PECOSRIV-DC-4 Populations of the endangered Holy Ghost ipomopsis are stable and thriving.

DA-ALLDA-G-1 Within designated areas, footprints of ground-disturbing fire-suppression activities should be as small as possible or located where ground disturbance has previously occurred.

The guideline (DA-ALLDA-G-1) would reduce the impacts of fire suppression to Holy Ghost ipomopsis. Some impacts would be limited, but not all negative impacts would be reduced or eliminated. As such, this program area *may affect and is likely to adversely affect* Holy Ghost ipomopsis and its habitat.

Effects of Critical Habitat and Primary Constituent Elements

No critical habitat has been determined or proposed.

Cumulative Effects and Climate Change

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area of impacts for a listed species. Timber harvest, prescribed burning activities, livestock grazing, road management, utility corridor maintenance and dispersed recreation occur on the adjacent nonfederal lands. The implications for Holy Ghost ipomopsis of climate change and variability with greater extremes of temperature and moisture could include declining acreage of forested habitat, greater risk of insect and disease impacts to habitat, and greater risk of stand-replacing wildfire. Roth (2018) also indicated that low reproductive rates in well- established transplanted plants might be due to drought conditions.

Summary and Determination of Effects

Summary

Restoration by wildfire and prescribed fire

Numerous factors within the five mile buffer of the proposed Holy Ghost Canyon management area make long term restoration of the fire regime in the area difficult.

- Approximately 31 percent of the area is wilderness, 24 percent is inventoried roadless area and 10 percent is private property.
- Because the population of Holy Ghost ipomopsis is so restricted to several cut slopes along Forest Road 122, the entire population is susceptible to sever impacts from catastrophic wildfire.

Road Maintenance

Because the only existing population of Holy Ghost ipomopsis occurs along Santa Fe NF Road 122, the species is very susceptible to activities associated with roads such as road use, road management, road improvement and road maintenance.

- Because this endemic has a very narrow distribution along an active Forest road it is vulnerable to various disturbances such as being picked, being ran over, being destroyed during road maintenance, ditch cleanout or road widening.
- Upgrading and maintaining the utility lines are also a potential threat.
- Road management has the potential impact this species by preventing new plant establishment by removing seeds or damage to reproducing plants.
- The use of herbicides to prevent encroachment of brush/shrubs can also remove Holy Ghost ipompsis.

Determination of Effects

The Holy Ghost ipomopsis is known from a single population on the Santa Fe National Forest, and continues to occupy about 80 ha (200 ac) of habitat (USFWS 2002).

This endemic has a very narrow distribution along an active Forest road it is vulnerable to dispersed recreation, utility corridor maintenance, road maintenance, competition from nonnative invasive species, succession of habitat into an unsuitable seral state, mineral extraction, climate change and catastrophic fire. Standards and guidelines are designed to limit the extent, level, and duration of potential effects from these impacts; however, LMP implementation does not provide for mitigation of all potential effects to a level that can be equated to or considered insignificant and/or discountable. Therefore, LMP implementation *may affect and is likely to adversely affect* the Holy Ghost ipomopsis and its habitat.

References

Bailey, Robert G. 1980. Description of the ecoregions of the United States. U. S. Department of Agriculture, Miscellaneous Publication No. 1391, 77 pp.

Bittner, S. L. and O. J. Rongstad. 1982. Snowshoe hare and allies. Pages 146-163 in J. A. Chapman and G. A. Feldhamer (eds.). Wild mammals of North America biology, management and economics. Johns Hopkins University Press, Baltimore, MD.

Certini, Giacomo. (2005). Effects of Fire on Properties of Forest Soils: A Review. Oecologia. 143. 1-10. 10.1007/s00442-004-1788-8.

Chambers, C.L. 2018. New Mexico meadow jumping mouse Project Report for 2015-2017. FWS Permit No.: TE63202B-1. School of Forestry, Northern Arizona University, Flagstaff, AZ, 60 pp

Chambers, C.L. 2019. New Mexico meadow jumping mouse (Zapus husonius lueus) Small Mammal Project Annual Report for 2019. FWS Permit No.: TE63202B-1. School of Forestry, Northern Arizona University, Flagstaff, AZ, 36 pp

Covington, W. W., and M. M. Moore. 1994a. Postsettlement changes in natural fire regimes and forest structure: ecological restoration of old-growth ponderosa pine forests. Journal of Sustainable Forestry 2:153-181.

Cummer, M. R. (2003). Email: Re: JMS salamander - Lakes Salvage Sale. C. Painter, NMDGF.

Dahms, C. W., and B. W. Geils. 1997. An assessment of forest ecosystem health in the Southwest.

DeBano, L. F., and Raymond M. Rice. 1971. Fire in vegetation management: its effect on soil. ***In*** Proceed-ings of symposium on interdisciplinary aspects of watershed management [A U ~.3-6, 1970, Bozeman, ~ o n t .] ,p . 327-345. Amer. Soc. Civil Eng. New York, N.Y.

DeBano, L.F., 1975. Infiltration, evaporation and water movement as related to water repellency. In: Soil Conditioners, Symposium Proceedings, Experimental Methods and Uses of Soil Conditioners (W.C. Moldenhauer, Program Chairman). 15–16 November 1973. Las Vegas, NV. Soil Science Society of America Special Publication Series 7. Madison, WI. pp. 155–163.

DeBano, L.F., Savage, S.M., Hamilton, D.A., 1976. The transfer of heat and hydrophobic substances during burning. Soil Science Society of America Journal 40, 779–782.

Degenhardt, W. G. 1974. Distribution, reproduction and ecology of the two New Mexican Plethodontids: the Jemez Mountains salamander, Plethodon neomexicanus and the Sacramento Mountain salamander, Aneides hardyi, USFS and the Western Interstate Commission for Higher Education.

Degenhardt, W.G., C.W. Painter, and A.H. Price. 1996. Amphibians and Reptiles of New Mexico. University of New Mexico Press, Albuquerque, New Mexico.

Elliot, W. J., I. S. Miller, and L. Audin, eds. 2010. *Cumulative Watershed Effects of Fuel Management in the Western United States*. Gen. Tech. Report RMRS-GTR-231. Fort Collins, Colo.: USDA Forest Service, Rocky Mountain Research Station.

Everett, E. (2003). Email: JMS - Lakes Salvage Sale. C. Painter and NMDFG.

Frey, J. K. 2005a. Status assessment of montane populations of the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) in New Mexico. Final Report Professional Services Contract number 05-516.57, submitted to Conservation Services Division, New Mexico Department of Game and Fish, Santa Fe, New Mexico, 74 pp.

Frey, J. K. July 25, 2005 (2005b). Informal report on the status of the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) in the Sacramento Mountains, New Mexico. Email 7 pp.

Frey, J. K. August 12, 2006 (2006). CN 2376 Fenton Lake: Rio Cebolla flooding impacts to jumping mouse habitat. Email, 2 pp.

Frey, J. K. April 3, 2006 (2006a). DBANWR: current management of irrigation canals Email, 1 pp.

Frey, J. K. July 31, 2006 (2006b). Biennial review-jumping mouse uplisting. Email, 3 pages.

Frey, J. K. March 31, 2006 (2006c). Synopsis of the New Mexico jumping mouse (*Zapus hudsonius luteus*) in the Rio Grande Valley, New Mexico. Unpublished Report, 6 pp.

Frey, J. K. 2006d. Status of the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) in the Sangre de Cristo Mountains, New Mexico. Final Report Professional Services Contract number 06-516-0000-0049, submitted to Conservation Services Division, New Mexico Department of Game and Fish, Santa Fe, New Mexico, 78 pp.

Frey, J. K. March 1, 2007 (2007). Jumping mouse. Email, 2 pp.

Frey, J. K. January 10, 2007 (2007b). Survey for the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) at selected locations in the Jemez Ranger District, Santa Fe National Forest. Final Report Professional Services Contract number AG-8379-P-06-0044, submitted to Santa Fe National Forest, 28 pp.

Frey, J. K. December 7, 2007 (2007d). Considerations for inventory of *Zapus hudsonius luteus*. Frey Biological Research, Radium Springs, New Mexico, 2 pp.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. BioScience, 41:540-551.

Griffin, P. C. 2004. Landscape ecology of snowshoe hares in Montana. Ph.D. dissertation, University of Montana, Missoula. 160 pp. Koehler, G. M., & Brittell, J. D. (1990). Managing spruce-fir habitat for lynx and snowshoe hares. *Journal of Forestry*.

Henley, W.F., Patterson, M.A., Neves, R.J., Dennis Lemly, A., 2000. Effects of sedimentation and turbidity on lotic food webs: a concise review for natural resource managers. Rev. Fish. Sci. 8 (2), 125–139.

Hubbard, J. P. 1978. Revised checklist of the birds of New Mexico. New Mexico Ornithological Society Publication No. 6: 5-6.

Huxman TE, Wilcox BP, Breshears DD, Scott RL, Snyder KA, Small EE, Hultine K, Pockman WT, Jackson RB. 2005. Ecohydrological implications of woody plant encroachment. Ecology 86:308–319. 10.1890/03-0583

Lawler, J.J., S.L. Shafer, D. White, P. Kareiva, E.P. Maurer, A.R. Blaustein, and P.J. Bartlein. 2009. Projected climate-induced faunal change in the western hemisphere, Ecology, 90(3), 588–597.

McCord, C. M., and J. E. Cardoza. 1982. Bobcat and lynx (Felis rufus and F. lynx). Pages 728- 768 in J. A. Chapman and G. A. Feldhamer, eds. Wild mammals of North America: biology, management, and economics. Johns Hopkins Univ. Press, Baltimore, MD.

Mills LS, et al. (2005) Pellet count indices compared to mark-recapture estimates for evaluating snowshoe hare density. J Wildl Manage 69(3):1053–1062.

Moody, J.A., 2001. Sediment transport regimes after a wildfire in steep mountainous terrain. *In* Proceedings of the Seventh Federal Interagency Sedimentation Conference. Reno, Nevada. X-41–X-48.Natureserve. 2019.

Moody, J.A. and D.A. Martin. 2001. Hydrologic and sedimentologic response of two burned watersheds in Colorado. U.S. Geological Survey Water-Resources Investigations Report, WRIR 01-4122. 142 pp

NatureServe Web Service. Arlington, VA. U.S.A.Available http://services.natureserve.org. (Accessed: September 2019)

New Mexico Endemic Salamander Team (NMEST). 2000. Cooperative Management Plan for the Jemez Mountains Salamander (*Plethodon neomexicanus*) on Lands Administered by the Forest Service.

Postel, S.L. and Thompson, B.H. (2005) Watershed Protection: Capturing the Benefits of Nature's Water Supply Services. Natural Resources Forum, 29, 98-108. http://dx.doi.org/10.1111/j.1477-8947.2005.00119.x

Ramotnik, C. A. (2003). Re: FW: JMS salamander - Lakes Salvage Sale. C. Painter, NMDGF

Reagan, D. P. 1967. Aspects of the life history and distribution of the Jemez Mountains Salamander, Plethodon neomexicanus. Biology. Albuquerque, University of New Mexico. Master's thesis. 38 pp.

Reagan, D. P. 1972. "Ecology and distribution of the Jemez Mountains salamander, Plethodon neomexicanus." Copeia 3: 486-492

Roth, D, 2018. *Ipomopsis sancti-spiritus* (Holy Ghost Ipomopsis) Recovery Summary Report (Section 6, Segment 32) 1996 – 2018. Prepared for the U.S. Fish and Wildlife Service, Region 2 Albuquerque, New Mexico. 31 pp.

Scott, R.L., T.E. Huxman, D.G. Williams, and D.e. Goodrich. 2006. Ecohydrological impacts of woodyplant encroachment: seasonal patterns of water and carbon dioxide exchange within a semiarid riparian environment. *Global Change Biology 12:311-24.*

USDA, 2018. Middle Rio Grande Southwestern Willow Flycatcher Study Results 2017. U.S. Department of the Interior, Bureau of Reclamation, Technical Service Center, Fisheries and Wildlife Resources, Denver, Colorado.

USFS. 2008a. Southern Rockies Lynx Amendment Record of Decision. USDA Forest Service, Rocky Mountain Region. October 2008. 78 pp.

U.S. Fish and Wildlife Service. 1990. Recovery plan for the interior population of the Least tern (Sterna antillarum). U.S. Department of the Interior, U.S. Fish and Wildlife Service. Albuquerque, New Mexico, USA.

U.S Fish and Wildlife Service. 1993. Endangered and threatened wildlife and plants: final rule to list the Mexican spotted owls as a threatened species. 58 FR: 14248-14271.

U.S. Fish and Wildlife Service. 1995. Recovery plan for the Mexican spotted owl: vol. I. USDI Fish and Wildlife Service, Albuquerque, New Mexico, USA.

U.S. Fish and Wildlife Service. 2004. Final designation of critical habitat for the Mexican spotted owl. 69(168) FR: 53182.

U.S. Fish and Wildlife Service. 2008. Final recovery plan for the northern spotted owl, *Strix occidentalis caurina*.

U.S. Fish and Wildlife Service Portland, 1999. Rio Grande Silvery Minnow Recovery Plan. Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. 2002. Holy Ghost Ipomopsis (Ipomopsis sancti-spiritus) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 51 pp.

U.S. Fish and Wildlife Service. 2002. Pages 39205-39235 *in* Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Rio Grande Silvery Minnow; Proposed Rule. U.S. Federal Register Volume 67.

U.S. Fish and Wildlife Service. 2003a. Pages 8088-8135 *in* Endangered and Threatened Wildlife and Plants; Final rule for the Designation of Critical Habitat for the Rio Grande Silvery Minnow. U.S. Federal Register Volume 68.

U.S. Fish and Wildlife Service. 2003b. Biological and Conference Opinions on the Effects of Actions Associated with the Biological Assessment of Bureau of Reclamations Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico. U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA. March 17.

U.S. Fish and Wildlife Service. 2004. *Hydrologic and Biologic Data for the Water-Quality Assessment in Relation to Rio Grande Silvery Minnow Habitats. Middle Rio Grande, New Mexico*. New Mexico Ecological Services Office, Albuquerque, New Mexico. July.

U.S. Fish and Wildlife Service. 2005. Draft recovery outline for the contiguous United States distinct population segment of the Canada lynx. Unpublished draft. USDI Fish and Wildlife Service, Region 6, Denver, Colorado. 21 pp.

U.S. Fish and Wildlife Service. 2005b. *Recovery outline, contiguous United States distinct population segment of the Canada lynx.* . Helena, MT: U.S.D.I. Fish and Wildlife Service, Region 6, Montana Field Office. .

U.S. Fish and Wildlife Service. 2008. *Habitat Assessment for Rio Grande Silvery Minnow (Hybognathus amarus) in the Cochiti Reach, at Peña Blanca, New Mexico*, Final Report Submitted to U.S. Corps of Engineers Albuquerque Division, Agreement No. 1448-22330-05-H009.

U.S. Fish and Wildlife Service. 2008. Holy Ghost Ipomopsis (Ipomopsis sancti-spiritus) 5-Year Review. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 15 pp.

U.S. Fish and Wildlife Service. 2010. Rio Grande Silvery Minnow (Hybognathus amarus) Recovery Plan, First Revision. Albuquerque, NM. viii + 210 pp.

U.S. Fish and Wildlife Service. June 6, 2012 (2012a). Memo to file: Site visits to *Zapus hudsonius luteus* localities in the Jemez Mountains. Albuquerque, New Mexico. 12 pp + photos.

U.S. Fish and Wildlife Service. June 21, 2012 (2012b). Memo to file: Site visit to *Zapus hudsonius luteus* locality in Coyote Creek State Park. Albuquerque, New Mexico. 8 pp + photos.

U.S. Fish and Wildlife Service. July 23, 2012 (2012c). Memo to file: Site visit to *Zapus hudsonius luteus* localities in Sugarite Canyon State Park. Albuquerque, New Mexico. 2 pp + photos.

U.S. Fish and Wildlife Service. October 2, 2012 (2012d). Memo to file: Site visit to *Zapus hudsonius luteus* localities on the Sacramento Ranger District. Albuquerque, New Mexico. 8 pp + photos U.

U.S. Fish and Wildlife Service. 2012b. Endangered and Threatened Wildlife and Plants; Proposed Endangered Status for the Jemez Mountains Salamander and Proposed Designation of Critical Habitat. Federal Register 77(177):56482–56513.

U.S. Fish and Wildlife Service. 2013. Draft Species Status Assessment Report New Mexico meadow jumping mouse (*Zapus hudsonius luteus*).

U.S. Fish and Wildlife Service. 2013a. Endangered and Threatened Wildlife and Plants; Determination of Endangered Species Status for the Jemez Mountains Salamander (Plethodon neomexicanus) Throughout Its Range. Federal Register 78(175):55599–55627.

U.S. Fish and Wildlife Service. 2013b. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Jemez Mountains Salamander. Federal Register 78(224):69569–69591.

U.S. Fish and Wildlife Service. 2012. Final Recovery Plan for the Mexican Spotted Owl (*Strix occidentalis lucida*), First Revision. U.S. Fish and Wildlife Service. Albuquerque, New Mexico,USA. 413 pp.

U.S. Fish and Wildlife Service. 2014. Incremental Effects Memorandum for the Economic Analysis for the Proposed Rule to Revise the Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx. 50 pp.

U.S. Fish and Wildlife Service. 2019. Holy Ghost Ipomopsis (Ipomopsis sancti-spiritus) Recovery Plan Amendment 1. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 20 pp.

U.S. Fish and Wildlife Service. 2019a. Information for Planning and Consultation (IPAC). 02ENNM00-2019-SLI-1123. Santa Fe National Forest, Forest Plan Revision. 17 pp.

Wilken, D., & Fletcher, R. 1988. Ipomopsis Sancti-Spiritus (Polemoniaceae), a New Species from Northern New Mexico. Brittonia, 40(1), 48-51. Retrieved from http://www.jstor.org/stable/2806875. DOI: 10.2307/2806875

Williams, J. L. 1986. New Mexico in maps. Albuquerque, NM: University of New Mexico Press

Appendix A. Proposed Probable and Possible Future Actions

Introduction

This appendix describes some of the proposed and possible management actions that may take place in the Santa Fe NF at the project or activity level during the planning period (approximately 10 to 15 years) to maintain or move toward desired conditions as described in this plan. Proposed actions are based off objectives described in chapters 2 and 3 of the plan and are designed to be clearly measurable outcomes that advance the specified resource toward desired conditions. Possible actions are management approaches drawn from chapters 2 and 3 that describe potential actions or strategies compatible with achieving desired resource conditions and objectives. Program strategies, inventories, assessments, resource analyses, and ongoing work with partners and cooperating agencies anticipated during the next 15 years are outlined below. Any objectives listed in chapters 2 and 3 have been modified to meet the directive requirements of possible projects within a 3- to 5-year timeframe (FSH 1909.12 Chapter 22.34).

This list is not intended to be all-inclusive; it is simply a list of possible actions that may take place based on the plan objectives and management approaches. This information is not a commitment to take any action and is not a "proposal" as defined by the Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA). During the life of the plan, the Santa Fe is not limited to these possible actions when proposing projects and activities. A plan amendment is not required to change of modify the possible actions. These probable and possible future actions can be updated at any time through an administrative change of the plan.

Proposed Management Actions

Objectives as outlined within chapter 2 and 3 of the plan represent projects or activities intended to be accomplished during the next 3 to 5 years of the planning period. These are listed below.

All Vegetation Types

Objective 1: Over a 10-year period, complete at least the following treatments to move vegetation resources toward desired conditions:

Vegetation ERU	Mechanical Treatment (acres)	Prescribed Fire and Naturally Ignited Wildfire (acres)
Mixed Conifer with Frequent Fire (MCD)	10,000–80,000	50,000–200,000
Ponderosa Pine (PPF)	15,000–100,000	150,000–250,000

Objective 2: Over a 10-year period, complete 2,500 to 50,000 acres of combined vegetation treatments in highly departed non-forested ERUs* to move vegetation toward desired conditions (i.e., restoration). Treatments may include mechanical treatments, prescribed fire or naturally ignited wildfires, seeding, or other techniques still to be determined by best available science, depending on the specific ERU.

*Highly departed non-forested ERUs are juniper grass (JUG), piñon juniper grass (PJG), Colorado Plateau Great Basin grassland (CPGB), sagebrush shrubland (SAGE), and montane subalpine grassland (MSG).

Water

Objective 1: Maintain "properly functioning" and improve at least two “impaired” or “functioning at-risk” watersheds (Watershed Classification Framework) every 10 years using the objectives from Vegetation ERUs, Aquatic Species, Water Resources, and Riparian Management Zones and Wetland Ecosystems.

Objective 2: Over 10 years, improve watershed function by decommissioning or mitigating impacts (e.g., maintenance, improvements, reroutes) on at least 100 miles of route (e.g., system roads, unauthorized routes, or trails) to the point of restoring hydrologic and ecological function.

Riparian and Wetland Ecosystems

Objective 1: Riparian ecosystems move toward desired conditions (less than a 33 percent departure from desired condition) for vegetation functional diversity, vegetation seral state, riparian corridor connectivity, and flood regime (frequency, duration, and magnitude) by implmenting15 miles of stream every 10 years. Actions that could improve riparian areas would be site–specific, but could include several of the following: removing invasive plant species, stabilizing the stream channel, restoring hydrologic connectivity between stream channel and riparian area, planting native species, promoting natural revegetation of bare ground, redirecting other uses (e.g., providing other watering sources, closing areas to camping).

Aquatic Species and Habitats

Objective 1: Complete aquatic restoration on priority projects that restore 30 miles of aquatic habitat (e.g., increase pool quantity, provide stream cover, remove or install fish barriers, restore beaver populations, or treat invasive aquatic species) every 10 years to benefit aquatic species.

Objective 2: Every 10 years, restore native fish species to 20 miles of streams where nonnative fish are absent and where natural or human-made fish barriers exist.

Terrestrial Species and Habitats

Objective 1: Maintain, improve, or install at least one water feature per year to improve water availability for wildlife or livestock where natural water sources are limited. These water features can serve dual purposes for both wildlife and livestock and can be done in conjunction with objective for water features in range section.

Objective 2: Restore or enhance at least 50,000 acres of terrestrial wildlife habitat during each 10-year period of the life of the plan. This may be done in conjunction with objectives for treatments in the vegetation section.

Nonnative Invasive Species

Objective 1: Eradicate or suppress invasive plant species on at least 600 acres annually.

Forest Products

Objective 1: Provide at least 177,000 CCF per decade to contribute to local forest product industry and for personal use, including 92,850 CCF (72,539 cords) per decade of fuelwood.

Sustainable Rangelands and Livestock Grazing

Objective 1: Annually remove, improve, or reconstruct at least 5 percent of the forest's range infrastructure that is no longer necessary or in poor or non-functional condition.

Objective 2: Maintain, improve, or install at least one water feature per year to improve water availability for wildlife or livestock where natural water sources are limited.[2.]

Developed Recreation

Objective 1: At two developed recreation sites, accomplish at least 75 percent of deferred maintenance projects every 3 years.

Dispersed Recreation

Objective 1: Maintain (clear, repair tread, brush, or improve drainage) on at least 25 percent of system trails every 3 years.

Objective 2: Verify and correct proper signage and alignment of trails on the ground and with maps and geospatial data (i.e., cartographic accuracy) for at least 25 percent of system trails every 3 years.

Objective 3: Undertake sustainably designed capital improvements (e.g., alteration, expansion, or new construction) on at least 1 mile of poorly designed or maintained trail every 3 years. The mile may be contiguous or non-contiguous.

Wilderness Areas

Objective 1: Within the life of the plan, at least 10 miles of high-priority boundary line will be surveyed and posted.

Continental Divide National Scenic Trail

Objective 1: During the life of the plan, connect the remaining unconnected segments (5 miles on NFS lands and approximately 7 miles within San Pedro Parks Wilderness) in the Cuba Ranger District.

Caja Del Rio Wildlife and Cultural Interpretive Management Area

Objective 1: Within 5 years of plan implementation, develop off-site interpretive materials (e.g., remote exhibits, brochures, or website information) for:

Objective 2: Portions of the National Historic Trails on the Caja del Rio to promote a sense of discovery for visitors.

Objective 3: Opportunities to view and protect the unique flora and fauna in the area.

Cultural Interpretive Management Areas

Objective 1: Within 10 years, develop at least one on-site interpretive tool that provides interpretation and educational information about each site.

Objective 2: Within 8 years, complete and stabilize the entire trail on each site to provide for site protection and visitor safety.

[2] These water features can serve dual purposes for both wildlife and livestock and can be done in conjunction with objective for water features in wildlife section.

Possible Management Actions

Management approaches as outlined within chapters 2 and 3 of the plan describe some of the possible management actions for achieving desired conditions and objectives. These are summarized below by resource area.

All Vegetation Types

- Consider management actions that replicate natural disturbance regimes.
- In support of restoration activities, consider using seeds or planting stock that is adapted to the ecological unit (or similar in elevation, soil type, and ecosystem) and to potential future conditions, to build resiliency in vegetative communities.
- In site-specific cases, consider scheduling management activities that result in accumulations of green slash to minimize potential impacts from bark beetles and avoiding accumulating green slash (greater than 3 inches in diameter) before overwintering beetles emerge (generally April to June) in areas highly susceptible to outbreaks.

Fire and Fuels

- Consider collaborating with stakeholders and partnering agencies early and often to successfully meet resource objectives through the use of fire while minimizing adverse impacts. Educate internally and externally the potential benefits, challenges and tradeoffs of wildland fire.
- Coordinate management of wildland fire across jurisdictional boundaries whenever there is potential for managing a wildfire or a prescribed fire on more than one jurisdiction (e.g., Federal, State, county, local, tribal governments, and land grants, etc.). This includes water sources, access, and land use agreements. This is done with the understanding that fire-adapted ecosystems and communities transcend jurisdictional boundaries. These are all foundational concepts of the collaboratively developed National Cohesive Wildland Fire Management Strategy.
- When planning and implementing fuels projects and all hazard response, work collaboratively with Federal, State, local governments, and private landowners; consider promoting public safety and reducing the risk of wildfire on lands of other ownership by supporting the development and implementation of community wildfire protection plans (CWPPs) or similar assessments and management plans to mitigate negative impacts of wildfire. CWPPs are also important tools for mitigation efforts such as wildfire preparedness, evacuation planning, and other mitigations that will aid in wildfire response.
- When conditions facilitate safe progress toward desired conditions, consider managing naturally ignited fires to meet multiple resource objectives concurrently (i.e., protection and resource enhancement), which can change as the fire spreads across the landscape.
- Wildfire objectives are based on interdisciplinary assessment of site-specific values such as desired conditions, existing fuel conditions, current and expected weather, fire location, resource availability, social and economic considerations, and values to enhance or protect; and consider courses of action to protect or enhance those values.
- Consider the use of planned and unplanned fire in areas such as steep and rugged terrain or remote areas, as this may be the only viable tool where mechanical treatments are not feasible.
- Consider implementing treatments where they provide the most benefit (e.g., values-at-risk) and improve or maintain ecological integrity (e.g., vegetative departure).

- When managing planned ignitions, consider creating conditions that enable future unplanned ignitions to mimic their historical role or to serve as a tool to achieve resource objectives and to move ecosystems closer to desired conditions.
- In areas departed or trending away from desired conditions, consider combining the use of fire with mechanical treatments, as this is often the most effective approach to restoring forest structure and function.
- In areas highly vulnerable to climate change, consider increasing resiliency by using a diversity of treatments to facilitate natural adaptation to changing conditions such as, managing in favor of early- to mid-seral species over late-seral species in ecotones, as species characteristic of lower life zones are adapted for warmer and drier conditions. Consider managing tree basal area at the low end of the range of desired conditions to mitigate water stress.
- Consider the importance of developing practices and protocols to reduce non-prescribed human ignitions by providing timely and disseminating widely fire danger and fire restriction information. Consider educating the public on their responsibility to help reduce human-caused wildfires by providing information in the form of signage, public contacts, and fire restrictions in locations such as trailheads and designated recreation areas.
- Consider the scenic effects from prescribed fire during project planning and implementation. Blackened and scorched vegetation may be visible in project areas in the short term following treatments, but take into consideration the long-term scenic integrity objectives.
- In wildland and managed fire areas that are not expected to reseed naturally, consider seeding with native vegetation and implement other site rehabilitation practices, as necessary. Consider that fire suppression support activities and facilities (including constructed fire lines, fuel breaks and safety areas, fire camps, staging areas, heli-bases, and heli-spots), follow the same site rehabilitation practices.
- Consider collaborating with scientists (e.g., from universities, Forest Service Research and Development, U.S. Geological Survey, or Ecological Restoration Institute) and other land management agencies or organizations to conduct research on areas impacted by uncharacteristic wildfire to understand how fire has altered the ecological conditions outside the natural range of variation and develop strategies to better manage these areas.
- Consider using the Wildfire Strategic Response Zones to facilitate informed and transparent decision making that will allow beneficial fires to burn under the right conditions, and inform aggressive strategies when fires need to be suppressed. Five strategic zones were developed for the Santa Fe NF: (1) maintain, (2) restore, (3) protect, (4) exclusion, and (5) high complexity. These zones are dynamic over time and space, and will change as conditions change, affecting management opportunities. For example, an area currently identified as ‘Restore’ zone could become a ‘Maintain’ zone after treatment (mechanical or fire). Conversely, a ‘Restore’ zone could become a ‘Protect’ zone if changing fuel conditions change expected fire behavior and effect such that fire would not meet forest plan desired conditions.
- Consider providing educational resources and outreach so that residents living within and adjacent to the forest are knowledgeable about wildfire protection of their homes and property, including providing for defensible space.
- Managers should consider using a decision support process to guide and document wildfire management decisions. The process will provide situational assessment, analyze hazards and risk, define implementation actions, and document decisions and rationale for those decisions.

- Wildland fire is understood, both internally and by the public, as a necessary disturbance process integral to the function and sustainability of ecosystems.

Water Resources

- Work with local, State, and Tribal governments, land grants, non-governmental organizations, and other stakeholders to identify improvement projects, priorities for protection and management of watersheds especially in priority watersheds (Watershed Condition Class Framework), and high-quality areas (e.g., designated and eligible Wild and Scenic Rivers, Outstanding National Resource Waters, and Wetland Jewels).

- Work closely with New Mexico Environment Department on water quality management in the forest (e.g., maintaining Memorandum of Understanding, development of Total Maximum Daily Load (TMDL) determinations, developing watershed-based plans, designing and implementing 319 grants).

- Work with acequia associations and permittees to maintain diversion structures and ditches in properly functioning condition and to remedy impacts (e.g., downcut channels, enlarged channels, loss of riparian habitat) that are caused by water diversions.

- Consider opportunities to secure instream flows (water rights) for the purposes of improving or sustaining aquatic and riparian ecosystems.

- Consider developing watershed-specific plans that prioritize specific roads for decommissioning to result in improved water quality and a smaller road system (administrative or public).

Riparian and Wetland Ecosystems

- Pursue partnerships for collaborative management of riparian and wetland areas.
- Collaborate with partners to communicate the ecological significance of riparian and wetland systems to the broader public and to garner support for restoration activities.
- Consider regional riparian and aquatic ecosystem strategies when formulating riparian management actions.
- Consider underlying causes for degradation at the watershed scale when planning or implementing restoration activities.
- Consider working with partners to develop wetland action plans for headwater wetland restoration projects to addresses wetland stressors by identifying and prioritizing mitigation and restoration actions.

Aquatic Species and Habitats

- Work collaboratively with the New Mexico Department of Game and Fish, government institutions (local, State, Tribal and Federal), and other organizations, individuals, and groups to plan and implement projects for the management and research of fish and other aquatic species and their habitats.
- Work with partners to develop and implement conservation strategies beneficial to aquatic habitats (e.g., Rio Grande Cutthroat Conservation Strategy, the State Wildlife Action Plan, etc.).

- During project planning, consider management actions to mitigate the effects of long-term and short-term climate fluctuations (e.g., climate change, drought, and El Niño Southern Oscillation).
- Prioritize restoration projects based on factors such as watershed conditions, at-risk species, restoring aquatic habitat connectivity, restoration after disturbances (e.g., fire or flood), partner interest, and other immediate needs.
- Work with partners to promote public education and valuing of the aquatic wildlife in the forest.
- Consider constructing beaver dam analogues to create similar beneficial conditions for aquatic and riparian habitats as reintroducing beavers while avoiding potential conflicts with adjacent land management.

Terrestrial Species and Habitats

- Work collaboratively with the New Mexico Department of Game and Fish and other organizations, government institutions (local, State, Tribal, and Federal), individuals, and groups to plan and implement projects for the management and research of wildlife and their habitats, including Rocky Mountain bighorn sheep.
- Collaborate with other adjacent land ownership to encourage an all-lands approach at a scale that improves landscape connectivity across mixed ownerships where natural systems span multiple administrative boundaries.
- Consider seasonal road restrictions and area closures to provide refuge in small and large blocks of land for a wide range of species.
- During project planning, consider mitigations to wildlife habitat resulting from the effects of long-term and short-term climate fluctuations (e.g., global climate change, drought, El Niño Southern Oscillation), and subsequent effects of management activities.
- Work closely with New Mexico Department of Game and Fish, other enforcement agencies and local communities to reduce incidence of poaching (e.g., encourage reporting, increase signage or maintain barriers for road closures).
- Work with partners to promote public education and valuing of the terrestrial wildlife in the forest.
- Work collaboratively with New Mexico Department of Game and Fish and New Mexico Department of Transportation as well as other organizations to identify corridors to improve or maintain connectivity for terrestrial species.
- Work with partners to develop and implement conservation strategies beneficial to terrestrial habitats (e.g., the State Wildlife Action Plan, etc.).

Nonnative Invasive Species

- Coordinate with the NMDGF and other agencies and pursue partnerships to manage terrestrial and aquatic invasive species.
- Consider educating and informing the public to prevent the introduction of invasive species and limit their spread.
- Encourage research on invasive species and pathogens by universities and other organizations and agencies. Coordinate with university research and programs such as the Cooperative Extension Service through New Mexico State University.

- Consider using the most recent New Mexico Department of Agriculture's "Noxious Weed Memo and List" to identify and prioritize invasive plant management needs. The invasive species with the highest treatment priority are Class A and B noxious weeds, which have made significant increases in their overall population size in the plan area during the last 10 years.
- Consider programs to address invasive plant species using integrated pest management strategies.
- Consider encouraging public land users to inspect and clean motorized and mechanized trail vehicles of weeds and their seeds before recreating on public lands.
- Consider encouraging fishers and hunters to prevent the introduction and spread of invasive species by inspecting their equipment for invasive species and taking preventative measures (e.g., do not use felt-sole wading boots).
- Consider encouraging public pack-animal users to use pelletized, weed-free feed.

At-Risk Species

- Work collaboratively with other agencies (e.g., USFWS, NMDGF, New Mexico State Forestry, etc.), universities, and nongovernmental organizations for the research and management of at risk species. Emphasis is placed on the protection and restoration of key habitats and habitat features that lead to their recovery and persistence.
- Strive to work with partners to promote public education and valuing of the at-risk species in the forest.
- Prior to management actions, conduct surveys to identify sessile (immobile) at-risk species in areas with the following features:
    - Limestone outcropping
    - Gypsum soils
    - Sandstone blended with Todilto gypsum or limestone
    - Gray to red shales and clays of the Mancos and Chinle formations in piñon-juniper woodlands
    - Volcanic pumice and unconsolidated pyroclastic ash in piñon-juniper woodland and lower montane coniferous forests
- Consider guidance from regional or local species conservation agreements, assessments, strategies, or guidelines to improve the status of at-risk species.
- Consider using geographic information systems (GIS) as the preferred database of record to record findings of at-risk species, including negative surveys.
- In coordination with New Mexico Department of Game and Fish, consider "dusting" prairie dog colonies with flea-controlling powder to reduce the spread of sylvatic plague, or distributing sylvatic plague vaccine. When possible, identify and potentially avoid burrows occupied with at-risk species prior to application.
- Collaborate with universities, State and Federal agencies (e.g., Forest Service Research and Development, U.S. Geological Survey, Natural Resources Conservation Service, New Mexico State Forestry, New Mexico Department of Game and Fish), and other organizations (e.g., The Nature Conservancy, Natural Heritage New Mexico, Native Plant Society of New Mexico, Trout Unlimited, Audubon Society, and other non-governmental organizations), to obtain data and encourage research on rare and endemic species.

- Consider alternative measures to projects that may decrease the likelihood of disease introduction or spread to at-risk species (e.g., do not dip firefighting buckets in waterbodies where didymo or whirling disease is known to exist or install drinkers instead of earthen tanks to prevent the spread of Chytrid fungus).
- Consider working with partners to promote public education and valuing of rare and narrow endemic species in the forest.

Soil Resources

- Work collaboratively with other agencies and groups that facilitate soil conservation, watershed improvement, and research projects.
- Consider developing and promoting programs that educate the public on the importance of staying on trails and not disturbing natural plant communities including biological soil crusts (e.g., Don't Bust the Crust!).
- Consider updating the TEUI (Miller et al. 1993), which provides the basis for planning project activities. Work with the Natural Resources Conservation Service and other partners to share data and improve existing soil information, especially after large-scale soil disturbances.
- Consider improving impaired and unsatisfactory soil condition ratings (as defined by TEUI) where management has resulted in degraded conditions:
    - To restore productivity and hydrologic function of compacted soils, consider using low ground pressure equipment.
    - To restore productivity and nutrient cycling, consider the application of soil amendments (e.g., biochar).
- Consider mitigating or restoring negative impacts in areas where concentrated use occurs on soils with severe erosion hazard rating or are poorly drained or saturated.

Air

- Work with agencies, organizations, tribes, and other entities to actively pursue actions designed to reduce the impacts of pollutants from sources within and outside the forest. These measures may include:
    - Documenting evidence of potential air quality impacts that supports initial and continued compliance with local, New Mexico, and Federal air quality regulations
    - Active membership in local and regional air quality protection stakeholder groups
    - Prevention of Significant Deterioration (PSD) permit review
    - Implementing air pollution mitigations where appropriate
    - Monitoring ambient air quality
    - Supporting visibility monitoring at San Pedro Parks
- Consider deploying instrument smoke monitors when there is potential for significant impacts to the public.
- Consider design features, best management practices, or mitigation measures to reduce fugitive dust where needed.
- When possible, consider using non-potable water for dust abatement strategies..

Partnerships

- Management approaches related to partnerships are found throughout this plan, typically as the first management approach for each resource.

Federally Recognized Tribes

- Coordinate with federally recognized tribes to develop collaborative proposals and implement projects of mutual benefit across shared boundaries, and use available federally authorized or advocated programs (e.g., Tribal Forest Protection Act of 2004 (Public Law 108-278) and the Collaborative Forest Restoration Program).
- Cooperatively develop interpretive and educational exhibits that focus on the history of the lands managed by the Santa Fe NF in collaboration with federally recognized tribes, land grant communities, and rural historic communities to provide the public with a greater understanding and appreciation of our shared history, culture, and traditions.
- Consider identifying sacred sites or traditional cultural properties, with tribal permission, and developing a strategy for appropriate recognition and management, including honoring the tribes' request for maintaining confidentiality.
- Consider providing training to forest employees so they gain an understanding of the unique government-to-government relationship between the Federal Government and federally recognized tribes; American Indian laws, customs, traditions, and values; and the tools available for protecting and managing sacred sites and traditional cultural properties.
- Refer tribal requests to collect threatened and endangered species to the U.S. Fish and Wildlife Service, the agency responsible for issuing permits for listed threatened and endangered species.
- Consider the physical and scenic integrity of places that federally recognized tribes regard as sacred sites, traditional cultural properties, or as part of important cultural landscapes when making project decisions or issuing special-use authorizations regarding the approval, location, and maintenance of facilities (e.g., telecommunication sites, ski areas, and recreational trails).
- Consider holding a workshop to inform interested tribes of Tribal Forest Protection Act provisions and opportunities for collaboration.
- Formalize working agreements with federally recognized tribes to understand their needs and build respectful, collaborative relationships; to develop ways of accomplishing mutually desired conditions and objectives; and to collaborate in ecosystem restoration efforts (such as memoranda of understanding, stewardship, and contracts).
- Consider identifying locations in the forest that can provide a setting for educating youth in culture, history, land stewardship, and the health benefits of outdoor activities.
- Consider acknowledging locations identified as important by federally recognized tribes and managing them with an emphasis on the resilience and protection of natural and cultural resources.
- Consider working with tribes to understand community needs and build respectful, collaborative relationships to achieve mutually desired conditions.
- Consider incorporating native language (e.g., Tanoan, Keres, and Athabaskan) into interpretive materials to highlight the American Indian culture as part of the landscape of the forest and its surrounding areas.

Rural Historic Communities

- Work with traditional communities and governing bodies for land grants and acequias to understand their needs and build respectful, collaborative relationships; develop collaborative proposals and implement projects of mutual benefit across shared boundaries and with shared infrastructure (e.g., boundary fences or roads); develop ways of accomplishing mutually desired conditions and objectives; and collaborate in ecosystem restoration efforts.
- Cooperatively develop interpretive and educational exhibits that focus on the history of the lands managed by the Santa Fe NF in collaboration with rural historic communities to provide the public with a greater understanding and appreciation of our shared history, culture, and traditions.
- Consider identifying forest locations that can provide a setting for educating youth in culture, history, land stewardship, and the health benefits of outdoor activities (e.g., through cooperation with cultural youth programs such as the Youth Conservation/Preservation Corps or others).
- Consider acknowledging locations identified as important by rural historic communities and managing them with an emphasis on the resilience and protection of natural and cultural resources.
- Consider providing training for forest employees to foster an understanding of the unique customs, traditions, and values of rural historic communities.
- Coordinate with rural historic communities and governing bodies for land grants and acequias to develop collaborative proposals and implement projects of mutual benefit across shared boundaries.
- Consider developing approaches for rural historic communities to continue to practice occupational- and subsistence-based activities that are sensitive to environmental and cultural concerns.
- Work with rural historic communities to identify areas where motorized and non-motorized access to resources important to cultural and traditional needs are vital.
- Consider incorporating Spanish language interpretive materials to highlight the Hispanic culture as part of the landscape of the forest and its surrounding areas.
- Consider ways to make fuelwood permits available locally in the field where the fuelwood is available or allow rural communities to get a fuelwood permit at the Forest Service district office closest to them or at another government office, rather than only at the district office administering the permitted area.
- Consider referencing the New Mexico Acequia Guidance document for clarification of authorities and responsibilities related to acequia management and governing body coordination.

Cultural and Historic Resources

- Consider maximizing opportunities for partnerships and volunteerism with the heritage program. Cooperate with local, State, and Federal agencies, as well as institutions and local federally recognized tribes in accomplishing program goals and objectives.
- Collaborate with federally recognized tribes and other traditional communities to manage historic sites and other traditional areas of importance.
- Collaborate with federally recognized tribes and other traditional communities to identify mitigation measures for historic properties, traditional cultural properties, and cultural landscapes during management activities.
- Work with partners such as the federally recognized tribes, Youth Conservation/Preservation Corps, land grants, acequias, New Mexico Historic Preservation Division SiteWatch program,

Archaeological Society of New Mexico, the National Park Service, and local museums to identify, study, protect, and monitor sites and artifact collections.

- Consider measures to improve relationships with federally recognized tribes and other traditional communities.
- Consider drafting new and updating existing memoranda of understanding with federally recognized tribes as needed.
- Consider using heritage programs, interpretive presentations, publications, and interactive learning opportunities to provide the public with opportunities to learn about, understand, and experience the forest's prehistory and history.
- Consider using programs (e.g., Youth Conservation/Preservation Corps, site stewards, volunteers, and Passport in Time) that engage the public to assist in protecting, managing, and documenting cultural resources.
- Consider updating the Forest Overview and Cultural Resources Planning Assessment into a comprehensive document to include a synthesis of known cultural data as well as lists of priorities for non-project survey, national register nominations, site stabilization, interpretation, and public involvement.
- Consider restoring select historic structures for appropriate recreation or interpretive use.
- When mitigating resource deterioration, consider implementing the following protective measures: vegetation treatment in and adjacent to site boundaries (provided appropriate protection measures are in place), signing, fencing, administrative closure, patrols, interpretive signs, stabilization, or data recovery.
- Prioritize non-project-related surveys as follows: (1) areas where historic properties are threatened or ongoing impacts are unknown and need to be assessed; (2) areas indicated to have high cultural value or high density of cultural resources; (3) areas of importance to traditional communities; and (4) areas where additional survey will contribute to a greater understanding of the prehistory or history.

Forest Products

- When planning and implementing projects, work collaboratively with Federal, State, local governments, federally recognized tribes, industry, environmental groups and private landowners to promote integrated ecological and social-economic goals of harvesting forest products to support a sustainable and appropriately scaled industry.
- Consider developing and promoting public education (e.g., brochures, signs, websites, and social media) on the ecological and social impacts of illegal activities and the importance of the sustainability of these resources.
- Consider designing variably sized timber contracts to accommodate a range of operations based in northern New Mexico communities.
- During the planning process, consider uneven- or even-aged timber harvest methods that reflect the scale of natural disturbances and are designed to achieve desired conditions (e.g., size class distribution, species composition, patch size, fuel reduction, insects and disease).
- In addition to treatments in highly departed frequent fire ERUs (e.g., PPF, MCD), consider treatments within infrequent-fire ERUs (e.g., spruce-fir forest, mixed conifer with aspen, and piñon-juniper woodland) for ecological and socioeconomic benefits.

- Consider designating and managing stands of mature or over-mature piñon for the gathering of piñon nuts and potentially restrict the harvest of firewood in these stands.
- Consider using woody material that results from management activities prior to on-site burning and chipping.
- Consider making fuelwood available through public access within a project area, providing some decked woody material along roads, or allowing collection within utility corridors being thinned.
- Consider preparing pest control plans with forest health specialists that contain appropriate mitigation measures (e.g., use of resistant tree species, maintenance of species diversity, removal of damaged trees, and pesticides) and monitoring procedures. Monitoring procedures might include:
    - Measure effectiveness of treated areas;
    - Determine effects on non-target organisms;
    - Determine effects on water quality; or
    - Determine effects of pesticide that enters the soil or air.

Sustainable Rangelands and Livestock Grazing

- Forest managers cooperate, collaborate, and coordinate with permit holders to respond to changing resource conditions. Cooperation, collaboration, and coordination among Santa Fe NF and permit holders is key to improving rangeland and forest conditions for multiple uses, moving toward desired conditions, and contributing to the socio-economic wellbeing of local communities. In addition, collaboration among stakeholders is important, including local communities; permit holders; and Federal, State, county, and local government entities.
- Develop partnerships with livestock grazing permit holders, agencies (e.g., the NMDGF), and other groups and individuals to develop collaborative proposals and implement projects that benefit multiple use on the forest.
- Coordination with livestock grazing permit holders should occur at the early stages of planning and project design to include local perspectives, needs, concerns, and traditional knowledge.
- When livestock grazing is modified as a response to changing resource conditions and permit holder needs, forest managers should first consider adjusting timing (which is easier for the permit holder), followed by intensity and frequency. Consider adjusting intensity at permit renewal. In addition, collaboration among stakeholders is important including the local interdisciplinary team; permit holders; Federal, State, county and local government entities; and non-governmental organizations.
- Acknowledge the economic, traditional, and cultural importance of livestock grazing to northern New Mexico families and consider providing Forest Service employees education on the importance of this traditional practice.
- Consider emphasizing large-scale landscape approaches and treatments for restoring rangelands and the use and perpetuation of a diversity of native plant species, with an emphasis on grass, forb, and shrub communities.
- Consider using an adaptive management strategy to manage livestock grazing in a manner that promotes ecosystem resiliency, sustainability, and species diversity, based on changes in range conditions, climate, and other resource conditions. Using the adaptive management strategy provides more flexibility to grazing management, while improving or maintaining rangeland health.
- Consider inviting association members and individual permit holders on range inspections.

- Consider modifying, relocating, or removing existing range facilities in water resource features, where their presence is determined to inhibit movement toward desired riparian or aquatic conditions and consistent with existing water rights and water quality and quantity.
- Consider how ungulates (e.g., elk, deer, and livestock) have cumulative impacts on Forest resources.
- Where an allotment fence intersects a designated trail, consider using a self-closing gate (e.g., easy-to-use gate, walk-through gate, or horseback accessible) to provide access for recreation users that does not risk livestock escape.
- In wetland or riparian areas that are functional-at-risk or non-functional, consider avoiding livestock grazing in the same area during the same vegetative growth and reproduction periods (e.g., leafing, flowering, or seeding) in consecutive years to ensure that riparian pastures have vegetative recovery.
- Consider grazing aspen groves early in the season and resting in the fall, and doing a rest rotation every 2 consecutive years out of every 5 years.

All Recreation

- Develop or enhance partnerships and collaborate with agencies, groups, communities, volunteers, permit holders, and other individuals to increase forest stewardship, ecological awareness, volunteerism, and user satisfaction; promote a sustainable recreation program; and support local recreation-based economic development.
- Promote established programs and develop new conservation education programs at schools, youth activities, fairs, and volunteer events that help connect people to nature, reach underserved populations, and encourage responsible use of natural resources.
- Convene and encourage multi-stakeholder groups to address recreation maintenance concerns in specific areas.
- Collaborate with livestock permit holders and recreationists to resolve conflicts.
- Consider multilingual interpretation in recreation areas popular with non-English-speaking visitors.
- Consider incorporating information technology (e.g., quick response (QR) codes, web addresses, or interactive maps) into signs and interpretive materials to direct public to additional information.
- Consider programs to educate the public on land stewardship using minimum impact principles (e.g., Leave No Trace, Tread Lightly, or Don’t Bust the Crust!).
- Consider issuing closure orders where there is excessive resource damage or to maintain public safety.
- Consider using sustainable operations at developed recreation sites (e.g., recycling receptacles, electric maintenance vehicles, etc.).
- Consider issuing closure orders to establish a 14-day limit for overnight occupancy at the same location within the Santa Fe NF (consecutive or not) within a 90-day period, except as allowed by permit.
- Develop conservation education, visitor information, and interpretation materials to inform and engage visitors and local communities. These resources are readily available and encourage increased forest stewardship, ecological awareness, visitor orientation, and knowledge of recreation opportunities. Consider developing materials in Spanish and native languages (e.g., Tanoan, Keres, and Athabaskan).

Developed Recreation

- Consider assessing the sustainability of the developed recreation program and prioritize sites for decommissioning, closing, or repurposing the facilities.
- Consider the volume of use, resource protection needs, and opportunities for public-private partnerships, geographic distribution, and operating costs, as well as public input, to determine the operation or closure of a site.
- Consider adaptively managing recreation facilities and shifting limited program resources to prioritized sites.
- Consider repurposing closed or unused facilities (e.g., fire towers, cabins, and recreation residences) as possible recreation rentals.
- Consider posting at developed recreation sites public safety and stewardship information that includes a welcome to the site as well as rules and regulations on recreational activities.

Dispersed Recreation

- Consider developing and implementing a plan for a forestwide trail system.
- Consider programs and educational techniques (e.g., brochures, signs, websites, and social media) that promote visitor knowledge of:
    - Proper non-motorized and motorized trail use etiquette;
    - "Leave no Trace" principles;
    - Fire prevention, especially how to properly extinguish campfires; and
    - At-risk species habitat
- Consider methods that would discourage the creation and use of non-motorized user-created routes (e.g., direct recreation to NFS trails).
- Consider methods that would discourage dispersed camping near cultural sites, sensitive habitat for at-risk species, interpretive sites, and water resources.
- Consider barriers and signage to control unauthorized use in areas with a high potential for illegal cross-country motorized vehicle use.
- At heavily used dispersed recreation sites, consider monitoring use and the following actions as potential mitigations: relocation, conversion to designated dispersed campsites, providing additional bathrooms, or restricting overnight use.
- Consider posting information and barriers to redirect use and encourage public compliance in site rehabilitation efforts.
- Where forage is limited, consider providing information to encourage overnight campers with saddle or pack animals to carry weed-free cubed, pelleted, or rolled feed to limit overuse of the vegetation and discourage establishment or spread of noxious weeds.
- Consider promoting clean camping practices (e.g., Leave No Trace, Pack-It-In, Pack-It-Out) at dispersed sites.
- Work with other entities to connect trails in Santa Fe NF with other trails on or through adjacent lands.

Recreation Special Uses

- Collaborate with New Mexico Game and Fish, New Mexico Council of Outfitters and Guides (NMCOG), and other New Mexico national forests to coordinate special-use authorization consistency for outfitters and guides. Consider convening an annual meeting between forest, State, and NMCOG representatives to discuss issues and management strategies.
- Consider creating a forestwide policy for administering common recreation special-use authorizations and non-compliance issues.
- Consider conducting capacity studies to determine the number of special-use authorizations that should be issued for popular commercial recreation activities.
- Consider directing applicants desiring special-use authorizations on heavily used areas to alternative areas that can better support the desired activities.

Roads

- Collaborate with federally recognized tribes to provide additional access to locations within the Santa Fe NF beyond what is available in the MVUM (e.g., through the Tribal Forest Protection Act).
- Within project areas, prioritize decommissioning of roads and routes that are redundant, that adversely impact flow regimes, that are not used by the public, or that cause resource damage.
- Consider mitigating or closing roads that may be susceptible to landslides, rock falls, or other landslide movements and hazard trees.
- Maintain relationships and communications with internal and external customers as well as partners. Consider notifying local governments, partners, adjacent landowners, permit holders, etc., of changes in road status and significant deviations in traffic patterns.
- Prioritize road system maintenance to provide for safe travel on all roads as well as to prevent or mitigate resource damage. Consider continuing current maintenance agreements and entering into new agreements with other entities including Federal, State, tribal, and local government agencies, as well as private organizations and individuals.

Facilities

- Consider a comprehensive preventive maintenance program for buildings and infrastructure to minimize major unplanned repairs or replacements.
- Prioritize infrastructure needs and investments for current need and long-term planning goals as described in facilities master plan, sustainable recreation plan, recreation facility analysis, and other resource planning documents, and health and safety requirements for employees and visiting public. All infrastructure with employee occupancy is subject to the Occupational Safety and Health Administration standards and will be evaluated regularly to protect the health and safety of forest employees, volunteers, and the visiting public.
- Consider decommissioning potable water systems that no longer serve the current needs.
- When work is being planned for administrative facilities and infrastructure that are historic resources, work with the heritage program and partnerships to administer and maintain facilities according to the facility master plan and any developed preservation maintenance plans (historic property plans)
- Consider partnerships with local, academic, State, Federal, tribal, non-governmental organizations, and special interest groups to conduct maintenance or to repurpose excess infrastructure as outlined in

facilities master plans, sustainable recreation plan, recreational facility analysis, and other resource planning documents, while following applicable standards and guidelines.

- During project planning and design, determine feasibility, cost, and benefits of using photovoltaic systems for administrative facilities, range improvements, resource monitoring, public safety, and recreation projects.

Cross-Boundary Management

- Collaborative relationships with adjacent landowners, users, and public land managers (e.g., counties, states, federally recognized tribes, and other federal agencies) are actively encouraged to develop contiguous road and trail systems across multiple ownerships.
- Collaborative relationships with traditional forest-dependent communities help ensure traditional and cultural uses are incorporated into the management of any newly acquired lands.
- Work with interested stakeholders to identify suitable parcels for acquisition and explore funding opportunities that leverage the Land and Water Conservation Fund, grant opportunities, and private financing.

Realty and Access

- Consider encouraging the protection of existing public access and the acquisition of new access opportunities to NFS lands.
- Consider updating the existing landownership adjustment plan, which will identify lands desirable for acquisition, as well as identify parcels or areas as suitable for exchange or sale.
- On easements acquired from private landowners, consider prioritizing public access interests over road closures.
- Consider using the following criteria to prioritize boundary management surveys:
    - Where known litigation is pending, a title claim has been asserted, encroachments are suspected, or the probability of encroachment can be reduced.
    - Where significant resource values exist and use or manipulation of resources is planned (this includes the location, by survey, of easements necessary for resource management).
    - To ensure that any project that occurs near or adjacent to any NFS boundary line does not proceed until the legal NFS boundaries are properly located and physically marked in the field prior to any management action.
    - To help prevent boundary disputes or loss of NFS land and its resources.
    - When all remaining property boundary lines have not been previously surveyed.

Lands Special Uses

- Consult with local governments to synchronize forest decisions for authorizations, permits, leases, and easements with local planning and zoning ordinances where local and forest objectives are complementary.
- Identify locations suitable for commercial filming for inclusion in a ‘menu’ of options subject to streamlined authorization.
- Recognize and grant priority status to applications for utility developments in existing transmission corridors that transmit energy from renewable sources.

Renewable Energy

- Consider identifying areas suitable for solar and wind energy based on energy potential, access, and impacts on other resources. Encourage development of wind and solar energy in these areas.
- Consider encouraging renewable energy devel9pment in areas with the highest generation potential and fewest resources conflicts by:
    - providing financial incentives to developers, including less frequent adjustments to rent and longer phase-ins for other fees;
    - allowing standard bonds as opposed to bonds based on full reclamation costs;
    - awarding leases in these areas through competitive processes; and
    - streamlining the leasing process by, for example, granting applicants site control earlier.
- Upon receipt of application for development of solar and wind energy facilities, consider modification of road designations and relocation to accommodate development of these renewable energy-producing facilities.

Solid Minerals

- Collaborate with the New Mexico Department of Game and Fish on pre-closure inspections of underground mines to determine if cave-dependent species are present, and if so, to determine how to design and implement a closure that addresses the needs of resident or historically occurring wildlife within the constraints of meeting public safety concerns.
- Prior to the destruction of access to adits, shafts, and other mine workings, consider providing opportunities to record mineral resource information when safe.

Caves

- Collaborate with other State and Federal agencies, non-governmental organizations, and universities as well as local, regional, and national speleological societies to identify significant caves, obtain data, encourage research on karst environments and karst-dependent species, and develop conservation strategies for protecting karst-dependent species and their habitats.
- Consider limiting logging, road construction, and other uses of heavy equipment above or in the vicinity of a cave with a thin roof, or the course of such a cave, if there is potential for damage.
- Consider retaining vegetation in the vicinity of a cave or cave course to protect the cave's microenvironment.
- If timber harvesting is permitted near a cave, consider directionally felling trees away from a cave and its course.
- Consider avoiding altering cave entrances or using them as disposal sites for slash, spoils, or other refuse.
- Consider limiting management activities within any area draining into a cave, as they may affect the cave ecosystem with sedimentation; soil sterilization; the addition of nutrients or other chemicals, including pesticides, herbicides, and fertilizers; or change the cave's natural hydrology.
- Consider avoiding the diversion of surface drainage into caves.
- Consider limiting public access to prevent damage to cave resources, when there are unusual safety hazards, or when it is necessary to prevent the spread of diseases such as white-nose syndrome.

- Consider avoiding advertising the location of caves to the general public in printed documents or with signs.
- Consider prohibiting camping and campfires within 200 feet of cave entrances, mines, and rock shelters used by at-risk species.
- Consider developing prescribed burn plans to avoid or minimize smoke influences at or around at-risk species bat caves.
- Consider recognizing and documenting karst features when they are found to occur across the landscape; these features include caves, springs, sinkholes, and losing streams.
- Consider incorporating measures for protecting caves into project plans for road construction, timber harvest, tree planting, blasting near caves, and any activity that could change cave temperatures and drainage patterns.

Scenic Resources

- Cooperate with other entities, such as the New Mexico Department of Transportation, tribal and local governments, and commercial and private entities to protect scenic integrity on and adjacent to the national forest, including along scenic byways.
- Consider developing public education opportunities and information about the importance and impacts of scenery.
- Consider providing the Scenery Management Inventory and Scenic Integrity Objective map to neighboring land management agencies for integration into projects and plans. These maps can be provided to others as interest is expressed for them.
- Consider best environmental design practices to advance environmentally sustainable design solutions (e.g., Sustainable Recreation Site Design Guide).
- Consider using the Forest Service Built Environment Image Guide in construction or reconstruction of Forest Service facilities to ensure consistency with the scenic character of the Southwestern Region.
- Set priorities for scenic integrity rehabilitation considering the following:
    - Foreground (within 300 feet to 0.5 mile) of high public use areas has the highest priority;
    - Amount of deviation from the scenic integrity objectives;
    - Length of time it would take natural processes to reduce the visual impacts so that they meet the scenic integrity objectives;
    - Length of time it will take rehabilitation measures to meet the scenic integrity objectives;
    - Benefits to other resource management objectives to accomplish rehabilitation;
    - Restoration of scenic integrity in areas where it has been negatively impacted as other project work is accomplished or funds are available; and
    - Where existing scenic integrity is lower than the scenic integrity map.
- Prior to vegetation work in developed recreation sites or administrative facilities, consider developing vegetation management plans that outline activities to sustain the desired scenic character and key visual elements over time.

- Consider the following types of activities to enhance scenic resources; restore grasslands and aspen, decommission or rehabilitate unneeded and unauthorized system roads and routes, remove unnecessary fences, and paint facilities along scenic byways.

Wilderness Areas

- Collaborate with local partners, volunteers, Adopt-a-Trail organizations, and other entities to maintain wilderness, including trails maintenance and construction.
- Coordinate with the New Mexico Department of Game and Fish on management of wildlife within wilderness using techniques consistent with preserving wilderness character.
- Wilderness management is guided by the elements outlined in the Forest Service's Wilderness Stewardship Performance (WSP) or other current guidance. This framework tracks how well the wilderness character is being preserved through measuring progress in 10 elements selected by managers for each wilderness from a suite of possible options (e.g., management of fire, range, and cultural resources).
- Consider adaptive management and corrective measures if overuse causes unacceptable resource damage or unacceptable loss of opportunities for solitude. Use proactive approaches in identifying and addressing visitor use management challenges before effects to resources become unacceptable.
- Prioritize the decommissioning, realignment, or reconstruction of trails in designated wilderness areas based on need, the amount of use it receives, and potential impacts on wilderness character and recreation opportunities.
- Consider using methods to prevent unauthorized use in wilderness such as education, law enforcement, barriers, road closures, and trail design.
- Consider dispatching a Resource Advisor-Fire Line (REAF) or Resource Advisor (READ) with a specialized knowledge of wilderness, or wilderness program specialist in the absence of a wilderness REAF or READ, to fires threatening wilderness.
- Consider using interpretation and education to encourage visitors to adopt techniques, equipment, and ethics specific to wilderness.
- Consider educating boaters on relevant safety and resource protection regulations before they enter the Chama River Canyon Wilderness. Post these regulations at river access points and include them in outfitter-guide special-use authorizations.
- Consider using news releases, postings, permit issuance, and individual visitor contacts to inform visitors of areas of concentrated resource damage and use restrictions.
- Consider rehabilitating human-caused disturbed areas (e.g., compacted sites) that are inconsistent with maintaining the natural appearance component of wilderness character.
- Consider reintroducing extirpated (locally extinct) or restoring populations of native species when consistent with ecological conditions and social values.
- Consider clearly identifying wilderness boundaries through signage at official entry points and needed locations (such as informal access points), with features such as trail maps, boundary markers, and consistent signage.
- Consider removing non-conforming structures from wilderness that are no longer in use and do not meet the desired conditions.

Inventoried Roadless Areas

- Prioritize roads in IRAs for road decommissioning.

Research Natural Areas

- Collaborate with appropriate agencies and universities regarding scientific opportunities of RNAs.
- Encourage partnerships and volunteers to provide onsite interpretation and monitoring for the RNAs.
- Consider marking the boundary of the RNA and using kiosks to educate the public about the RNA purpose, permitted, and prohibited activities.

Wild and Scenic Rivers

- Coordinate planning and management of the boating aspects of the Rio Chama with the Bureau of Land Management (BLM), in consultation with interested stakeholders, such as the Bureau of Reclamation; the Army Corps of Engineers; New Mexico Department of Game and Fish; and U.S. Fish and Wildlife Service.

Jemez National Recreational Area

- Work with volunteer groups, partners, local governments, and adjacent landowners to:
  - protect the condition and character of the surrounding landscape, and
  - facilitate support that promotes 'Leave No Trace' principles and reduces user conflicts.

Caja del Rio Wild Horse Territory

- Consider developing partnerships with other Federal Government agencies such as the Bureau of Indian Affairs, Animal and Plant Health Inspection Service, Fish and Wildlife Service, the State of New Mexico, universities, cattle and range organizations, advocate organizations, federally recognized tribes, adjacent land owners, and grazing permittees.
- Consider developing an AML and management plan, including coordinating with the BLM and the Pueblo of Cochiti.
- Monitor horse numbers within active territories at least every 3 to 4 years.

Significant Caves

- Consider measures to prevent human-caused changes in cave ecosystem, water, sediment, nutrient, chemical, airflow, humidity, or temperature regimes.

Continental Divide National Scenic Trail

- Work with volunteer groups; partners; ; Federal, State, Tribal, and local governments; and adjacent landowners to maintain CDNST corridors, the condition and character of the surrounding landscape, and to facilitate CDNST user support that promotes 'Leave No Trace' principles and reduces user conflict.
- Consider working with partners to promote public education about the history, purpose, and benefits of the CDNST.
- Consider ensuring that incident management teams are aware of the CDNST as a resource to be protected during wildfire suppression activities. Consider clearly identifying fire suppression rehabilitation and long-term recovery of the CDNST corridor as high priorities for incident

management teams, burned area emergency response teams, and post-fire rehabilitation interdisciplinary teams.

- Consider establishing appropriate visitor use levels for specific segments of the CDNST and taking appropriate actions if there is a trend away from the desired condition.
- Consider evaluating proposed trail relocations or new trail segments (e.g., using methods such as the Optimal Location Review process for substantial trail locations) for the CDNST, including to locate the CDNST as close as possible to the geographic Continental Divide.
- Consider identifying and pursuing opportunities to acquire lands or rights-of-way within or adjacent to the CDNST as they become available.
- Consider providing consistent signage along the CDNST corridor at road crossings to adequately identify the trail and including interpretation at trailheads.
- Consider using side and connecting trails to access points of interest or supplying points away from the CDNST.

National Historic Trails

- Rely on the cooperative management efforts and support of State, local, and private interests, including trail advisory councils, to ensure the protection of trail-related resources, to provide outdoor recreational opportunities, to maintain and build trail facilities, and to accomplish the objectives of interpretive programs with a focus on assisting visitors to understand and appreciate the trails' history and significance.
- Consider inventory and identification of intact trail segments (including reroutes and alternative alignments) in coordination with the National Park Service and Bureau of Land Management, as appropriate. Consider working collaboratively to ensure that signs installed along the route follow the sign plan indicated in each trail's comprehensive plan.
- Request a landscape architect or other scenery specialist to analyze all proposed projects for impacts to scenery in all distance zones (foreground, middleground, and background) associated with an NHT corridor.
- Consider implementing controlled surface use stipulations within the trail corridor on Federal lands and on lands of other ownership where Federal subsurface rights exist.

National Recreation Trails

- Work with volunteer groups, partners, local governments, and adjacent landowners to:
    - ♦ maintain trail corridors,
    - ♦ maintain the condition and character of the surrounding landscape, and
    - ♦ facilitate support by trail users that promotes 'Leave No Trace' principles and reduces user conflict.

Scenic Byways

- Work with the New Mexico Department of Transportation and county highway departments to manage hazard trees within the immediate foreground of scenic byways (up to 300 feet on either side).

- Work with the New Mexico Department of Transportation, the Federal Highway Administration, and local communities to improve services and interpretive opportunities on byways.
- Consider using signs, kiosks, exhibits, and other educational tools (e.g., brochures, auto tours, websites, and social media) to provide interpretive, educational, and safety information along scenic byways, in adjacent recreation sites, and at visitor contact points (e.g., ranger stations).

Caja Del Rio Wildlife and Cultural Interpretive Management Area

- Use cross-agency collaboration (e.g., National Park Service, Bureau of Land Management, Cochiti Pueblo, and Los Alamos National Laboratory) and tribal consultation to facilitate wildlife connectivity and protection of important archaeological, cultural, and sacred sites.
- Consider closures (e.g., for activities such as target shooting or drone use) to protect wildlife and maintain increased potential for wildlife-viewing opportunities.
- Consider conducting condition assessments and developing stabilization plans on significant ancestral pueblos.
- Consider discouraging take-off and landing of drones in or near canyons to avoid effects to at risk wildlife species.

Cañada Bonita Recommended Research Natural Area

- Collaborate with appropriate agencies and universities regarding scientific opportunities.
- Encourage partnerships and volunteers to provide onsite interpretation and monitoring.
- Consider marking the boundary of the Cañada Bonita RNA and using kiosks to educate the public about the area's purpose, and permitted and prohibited activities.

Cultural Interpretive Management Areas

- Coordinate with federally recognized tribes and pueblos, and local communities to discuss local access and needs on the sites, construction of trails, and development of interpretive materials.
- Consider providing a Forest Service representative (e.g., staff, law enforcement, volunteers, tribal members) at the sites during high-use holiday weekends to ensure site protection as well as provide interpretive information.
- Consider an intensive cultural resource survey of the entire management area to document the full extent of the site itself and better understand its context in the surrounding landscape.
- Consider developing a management plan for the interpretation and stabilization of each site, including:
    - A baseline condition and stabilization needs assessment of the sites, and
    - Periodic follow-up assessments every 2 years to evaluate the impacts to the sites.

Oil and Gas Leasing Management Area

- Consider working with the New Mexico Department of Game and Fish to identify where and when timing limitations are implemented pertaining to deer and elk winter range and deer and elk fawning and calving habitat.

Eligible Wild and Scenic Rivers

- Opportunities for enhancing ORVs may be considered in all project management activities within an eligible wild and scenic river corridor.