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Gila National Forest
Draft Revised Forest Plan

Draft Environmental Impact Statement

Catron, Grant, Hidalgo, and Sierra Counties, New Mexico

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Cover Photo: View to the Tularosa Mountains by Annette Smits

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Abstract: To comply with the National Forest Management Act and address changes that have occurred over the past 30 years, the Gila National Forest proposes to revise their existing land and resource management plan. This programmatic draft environmental impact statement documents analysis of impacts of five alternatives developed for programmatic management of the 3.3 million acres administered by the Gila National Forest. The analysis displays anticipated progress toward proposed desired conditions, as detailed in the Draft Revised Forest Plan, as well as the potential environmental and social consequences of implementing each alternative. Alternative 1 is the no-action alternative, which is the 1986 Forest Plan, as amended. Alternative 2 is the proposed revised plan and is reflected in the accompanying Draft Revised Forest Plan. This alternative addresses the needs for change since the Forest Plan was published and is the agency's proposed action. It promotes the Gila's niche of: dispersed recreation, traditional uses, and restoration. Alternative 3 maximizes mechanical restoration of grassland and open-canopy woodlands, while Alternative 4 maximizes mechanical restoration of forests and both alternatives limit the use of fire and emphasize access to traditional recreational, cultural, and historical uses of the forest. Alternative 5 emphasizes natural processes and maximizes wilderness recommendations.

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Contents

List of Tables

List of Figures

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Commonly Used Acronyms

AUM	animal unit month
BASI	best available scientific information
BLM	Bureau of Land Management
BMP	best management practice
CCF	hundred cubic feet
CDNST	Continental Divide National Scenic Trail
CF	cubic feet
CFR	Code of Federal Regulations
CWD	coarse woody debris
DEIS	draft environmental impact statement
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of Interior
EA	environmental assessment
EDRR	Early Detection Rapid Response
EIS	environmental impact statement
EPA	Environmental Protection Agency
ERU	ecological response unit
ESA	Endangered Species Act
FEIS	final environmental impact statement
FIA	Forest Inventory and Analysis
FSH	Forest Service Handbook
FSM	Forest Service Manual
FY	fiscal year
GIS	geographical information system
GNF	Gila National Forest
IRA	inventoried roadless area
ML	maintenance level
MMCF	million cubic feet
MOU	memorandum of understanding
MVUM	motor vehicle use map
n.d.	no date
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFS	National Forest System
NFSR	National Forest System road
NFST	National Forest System trail
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NM	New Mexico
NMDGF	New Mexico Department of Game and Fish

NMED	New Mexico Environment Department
NMRPTC	New Mexico Rare Plants Technical Council
NPS	National Park Service
NRHP	National Register of Historic Places
NVUM	national visitor use monitoring
NWI	National Wetland Inventory
OHV	off-highway vehicle
OML	operational maintenance level
ONRW	outstanding national resource water
ORV	outstandingly remarkable value
PILT	payment in lieu of taxes
P.L.	Public Law
PM	particulate matter
RNA	research natural area
ROD	record of decision
ROS	Recreation Opportunity Spectrum
SCC	species of conservation concern
SHPO	State Historic Preservation Office
SMS	Scenic Management System
SRS	Secure Rural Schools
TCP	traditional cultural properties
TEU	terrestrial ecological unit
TMR	Travel Management Rule
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTV	utility terrain vehicle
VDDT	Vegetation Dynamics Development Tool
WPA	Works Program Administration
WSA	wilderness study area
WUI	wildland-urban interface

Chapter 1. Purpose of and Need for Action

Introduction

A forest plan is the principal document that guides decisions about national forest land and resource management. Forest plans, which are intended to be applicable for 15 years, are required by the National Forest Management Act (NFMA) of 1976. The current Gila National Forest Plan was approved in 1986. Since then, the forest plan has been amended 11 times to reflect changes in social, economic and ecological conditions. The 1986 plan was written following guidance in the 1982 planning rule and related Forest Service directives. Gila National Forest (NF) staff are revising the 1986 plan using the provisions of the 2012 Planning Rule, as outlined in 36 Code of Federal Regulations - Part 219 and the accompanying Planning Rule Final Directives.

The 2012 Planning Rule is intended to create plans that guide integrated resource management in the plan area, or lands administered by the Gila NF, within the context of the broader landscape. It takes an integrated approach that recognizes the interdependence of ecological processes with social, cultural and economic systems. The approach uses best available science and local knowledge to inform decisions along the way. Collaboration with stakeholders, including New Mexico's many cultural groups with deep and long-standing ties to the landscape, and transparency of process are key ways the 2012 Planning Rule guides creation of forest plans for the future.

The Forest Service has prepared this draft environmental impact statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This draft environmental impact statement discloses environmental impacts that would result from the proposed action of revising the forest plan and alternatives.

Also contained within this DEIS, at the discretion of the forest supervisor, is a separate, project-level proposal and environmental analysis for herbicide use. Information about the plan-level and project-level herbicide use proposals are kept separate and distinguished from one another under separate headings. The separate herbicide use analysis is included in this document because the forest supervisor determined it was more efficiently conducted alongside the revised plan analysis (FSH 1909.12 section 21.7). While these two separate analyses are included in the same DEIS, the forest supervisor intends to ultimately make two separate decisions, in two different records of decision, supported by two different final environmental impact statements (FEIS).

Background

Located in southwestern New Mexico, the Gila NF was established in 1905[a], and covers about 3.3 million acres. The Gila NF is one of five national forests in New Mexico, and includes National Forest System (NFS) lands managed by Apache NF east of the Arizona-New Mexico state line. The Apache NF was divided at the state line, with the administration of those lands in Arizona being delegated to then Sitgreaves NF (now Apache-Sitgreaves NFs), and the administration of those lands in New Mexico being delegated to the Gila NF. All references to the Gila NF include those lands that were formerly part of the Apache NF.

The Gila NF is divided into six ranger districts: Quemado, Reserve, Glenwood, Silver City, Wilderness, and Black Range. These ranger districts are located within portions of Catron, Grant,

[a] The Gila Forest Preserve was originally established in 1899, prior to the establishment of the Forest Service.

Hidalgo, and Sierra Counties (see figure 1). The forest shares borders with the Apache-Sitgreaves NFs, Gila Cliff Dwelling National Monument, land administered by the Bureau of Land Management (BLM) and the State of New Mexico, and private property owners.

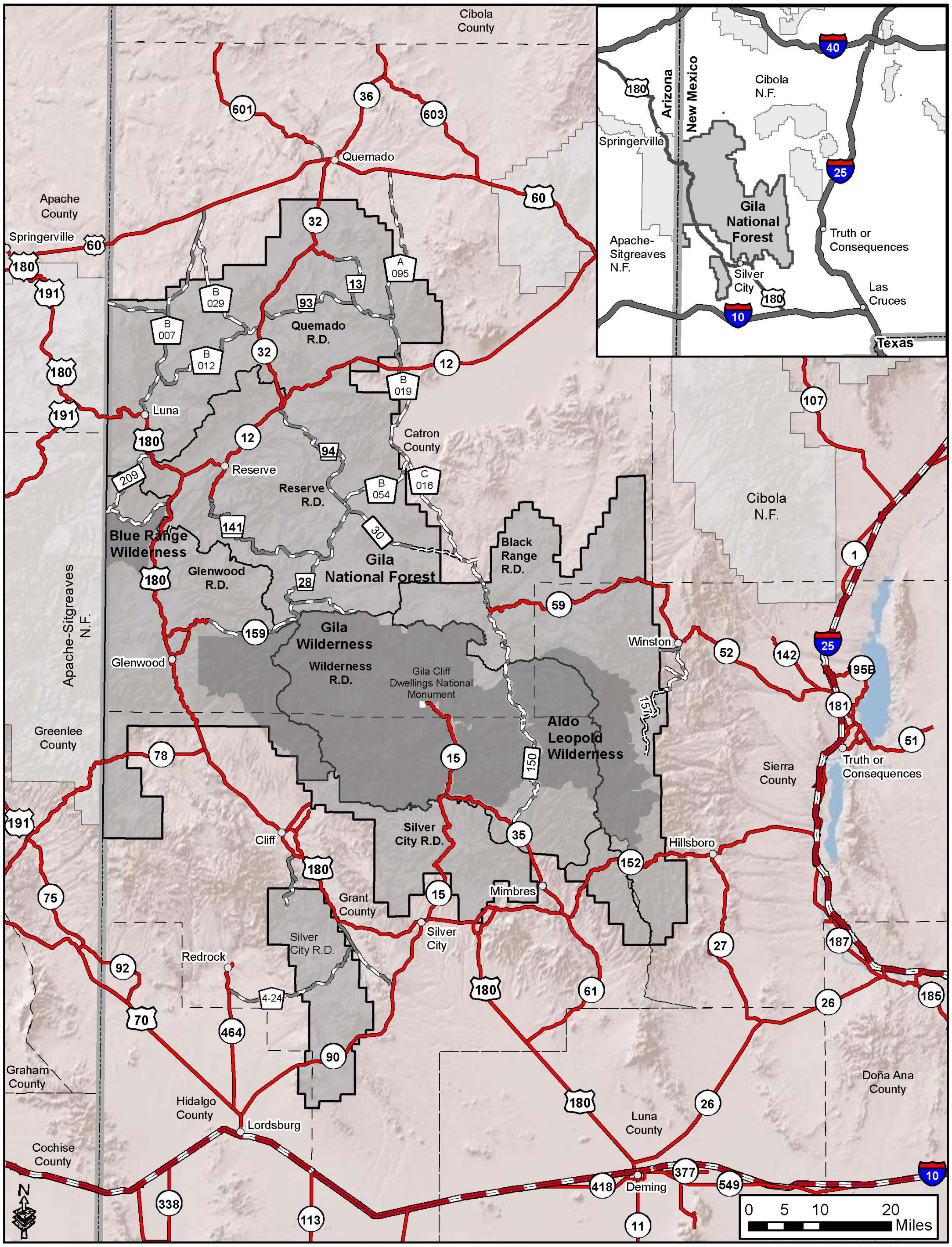

Figure 1. Location of the Gila National Forest showing county boundaries and major highways. The inset shows the location of the Gila NF within New Mexico

The forest has 12 mountain ranges and an elevational range of 4,160 to 10,770 feet. Annual precipitation ranges from approximately 11 inches in the northern end of the forest near Quemado and on the southern end of the Black Range to over 35 inches in the higher elevations of the Black Range and Mogollon Mountains. The forest includes semi-desert grasslands and shrublands, woodlands, ponderosa pine, mixed conifer and spruce-fir life zones. Major streams include the Mimbres River, the Gila River and its tributary, the San Francisco River.

Purpose and Need for Action

Plan-Level

The Gila NF is revising its 1986 forest plan as required by the NFMA. The revised plan is designed to meet the legal requirements of the NFMA and to incorporate new scientific and traditional cultural knowledge. The revised plan represents the forest-level direction that guides the forest in meeting the mission of the forest Service and managing its lands to provide for healthy, resilient ecosystems that meet the diverse needs of the American people.

The NFMA directs that forest plans be revised on a 10- to 15-year cycle. Over 30 years have passed since the regional forester approved the original forest plan in 1986; this plan has been amended 11 times since. The last 30 years have provided new scientific information and understanding, and changes in economic, social, and ecological conditions. A revision of the 1986 forest plan is needed to: (1) meet the legal requirements of NFMA and the provisions of the 2012 Planning Rule, (2) guide natural resource management activities in the forest for the next 10 to 15 years, and (3) address the needed changes in management direction.

The Gila NF's 2017 final assessment report provided information about ecological, social and economic conditions, trends, and risks to sustainability. The final assessment report also served as the basis for identifying 54 individual needs for change in management direction (found in the final Need for Change document), upon which the draft plan is based. A "need for change" describes a strategic change to the current (1986) forest plan necessary to address issues identified in the assessment report. Following is a summary of the needs for change statements addressing risks to sustainability.

Plan-Wide Changes

The ability of the Gila NF to continue providing desired social and economic benefits associated with recreation and tourism, ranching, hunting, timber, and other natural resources is affected by changing social, economic, and environmental conditions. The successful implementation of this forest plan requires good working relationships between the Gila NF and all stakeholders. The forest has not always capitalized on partners who are willing to help, and struggles to reach all stakeholders, which challenges relationships. The current forest plan imposes internal management boundaries, often with different management direction, which artificially fragments the landscape within the forest boundary and creates unnecessary complexities. Many advances in scientific understanding, methods, and technology have occurred since 1986. The monitoring plan has not been amended for quite some time, and it is out of date with current science and trends in resources. To address these issues, there is a need to:

- Develop a desired condition to recognize and improve the forest's role in contributing to local economies through recreation and tourism, timber and forest products, livestock grazing, and other multiple-use related activities and products, while balancing these uses with available resource capacity and emerging opportunities.

- Use collaboration with stakeholders, partnerships, and volunteer opportunities as a management option to strengthen relationships and to promote movement toward desired conditions.
- Strategically leverage and streamline processes for engaging partners and volunteers during project implementation and monitoring.
- Emphasize public education about the Gila NF's diverse ecological, social, and economic resources; the multiple-use sustained yield philosophy; public laws and regulations; shared use ethics; and management strategies.
- Connect people—particularly youth and underserved populations—with public lands and nature.
- Reevaluate the number, arrangement, and boundaries related to current forest plan management areas.
- Encourage working with neighboring land managers to implement projects at a scale that improves landscape-scale connectivity across mixed ownerships where natural systems span multiple administrative boundaries.
- Develop a monitoring program that collects relevant data, tracks progress toward desired conditions, distributes information consistently, and allows for a responsive adaptive management program with available resources, and uses updated terminology and methodologies.

Ecological Changes

Past fire suppression, historic overgrazing, and other activities have disrupted many natural processes, such as wildfire and natural vegetation succession. In the meantime, factors such as climate change, drought, and uncharacteristic fires have made upland vegetation more vulnerable to insects, diseases, and non-native species, and have impacted soils, watersheds, riparian ecosystems and aquatic habitat. Restoring historic vegetation conditions can increase environmental resiliency, but restoring natural ecological processes such as fire is key to sustainability. Restored, resilient, and connected habitats are also necessary to maintaining species diversity across the national forest. Fire is an important tool, but it is not the only tool available to facilitate restoration. Mechanical and manual vegetation treatments, along with managed fire, are expected to occur more often and over larger areas. These types of treatments sometimes produce increases in shade-intolerant, re-sprouting native species such as alligator juniper. While there is not currently an issue with invasive species, in the coming years, such species may compound the challenges in effectively restoring ecosystem resiliency. To address these issues, there is a need to:

- Promote ecological restoration and resilience.
- Promote the restoration and maintenance of native herbaceous vegetation, and limit woody species encroachment or infill and non-native invasive plant establishment.
- Increase flexibility for the restoration and maintenance of fire as an ecological process while addressing firefighter and public safety and health concerns.
- Recognize the natural role of fire and its use as a management tool to help reduce fuel accumulations, reduce the risk of future undesirable fires, improve wildlife habitat and range conditions, and improve watershed and overall forest health.
- Address vegetation structure within the wildland-urban interface.

- Restore, maintain, and sustainably manage watershed condition.
- Develop adaptive management approaches for water-dependent resources and multiple uses.
- Inventory, restore, maintain, and sustainably manage riparian areas, including those associated with springs, seeps, and wetlands.
- Manage toward terrestrial, riparian and aquatic habitat and population connectivity for terrestrial and aquatic species movement across the landscape, while allowing for the restoration of the range of native species.
- Support ecological conditions that contribute to the conservation and recovery of federally recognized species, as well as maintain viable populations of species of conservation concern and other native species.
- Update plan direction regarding integrated pest management and provide plan direction on the use of pesticides for restoration.
- Address the presence of non-native species by encouraging the removal of existing populations and limiting the introduction and spread of new populations.

Social, Cultural, and Economic Changes

For many years, the lands of the forest have provided economic, social, and religious value to Native Americans, Hispanics, and Anglo-American communities. The continued use and access to the forest contributes greatly to the continuation of local culture and tradition. The previously identified risks to ecological integrity and sustainability may impact the forest's ability to contribute to some of the social, cultural and economic benefits desired and enjoyed by people in local communities, surrounding areas and visitors to the area. Woody species encroachment, climate change, drought, and invasive species may reduce rangeland productivity, while fire restoration objectives and the protection of endangered and threatened species can pose range management challenges. Forest restoration and landscape-scale restoration projects can help sustain forest and watershed health, and maintain the ability to sustainably meet local demand for forest products.

The Gila NF features a diverse range of recreational opportunities and recreational demands are increasing. Roads and trails across the forest are necessary for access and fire management, and facilitate multiple uses, but limited funding has led to an increasing amount of deferred infrastructure maintenance. Historic and cultural sites are not fully inventoried and are vulnerable to natural and human processes such as erosion, wildfire, and recreational use. Designated areas represent identified exceptional areas that have distinct or unique characteristics warranting special designation. The plan revision process includes an inventory and evaluation process for lands and rivers that may be suitable for congressional designation, and other potential administrative designations will also be considered. To address these issues, there is a need to:

- Provide management direction for historic and contemporary cultural uses, including both economic and noneconomic uses for tribes and for those traditional communities not considered under tribal relations.
- Consider the value and importance of areas that may be identified as part of an important cultural landscape by tribes.
- Update plan direction for livestock management that incorporates increased flexibility and adaptive management to restore and maintain ecological integrity of rangelands.
- Update timber suitability determinations consistent with updated plan desired conditions.

- Address the long-term sustainability, changing trends in demands, and intended use of recreation infrastructure, trails, and facilities.
- Update plan direction for road maintenance prioritization and decommissioning of unneeded roads that accounts for budgets or resource needs and constraints, but also involves affected stakeholders.
- Emphasize the importance of scenery and recreation opportunity effects when planning projects.
- Stabilize, preserve, interpret, and protect historic and sensitive cultural properties.
- Manage existing or potential new designated areas to maintain desired character and values unique to each area.
- Encourage the protection of existing public access and the acquisition of new public access opportunities to NFS lands.
- Develop plan direction related to Forest Service land adjustments that are not covered by the existing forest plan.
- Include education and communication of policies regarding recreational mining and non-commercial rock and mineral specimen collection activities.

The purpose of this DEIS is to evaluate different programmatic strategies (or alternatives) for revising the existing land management plan (1986 plan) and disclose the potential environmental consequences of these alternatives.

Herbicide-Use

There is a need to expand treatment options and treatment area to include the entire forest to effectively suppress, contain, control, and eradicate noxious weed species into the future. The purpose of the project is to cost-effectively treat these plants. The forest's current NEPA decisions for noxious weed treatment projects is outdated.

The current noxious weed treatment NEPA analysis is outdated because it does not include an adequate range of available tools, limits the location of treatment, and does not authorize treatment of the necessary range of species. These deficiencies make it difficult for the Gila NF to implement Early Detection Rapid Response (EDRR) strategies, as there is no mechanism to effectively treat new infestations in a timely manner. Limiting the range of available tools also opens a window for noxious weed species to develop resistance to those particular herbicides, which may reduce or eliminate their utility in the future. Noxious plant treatment is intended to contribute toward meeting desired conditions within the proposed draft revised forest plan.

Currently, designated noxious weeds are generally not known to be well-established in the Gila NF, in contrast to many other western forests. However, that does not mean this will remain the case into the future. There are tremendous opportunities for successful management of the known noxious weed populations and successful EDRR into the future if appropriate decisions and risk-minimizing standards are in place. Success also depends on the forest and stakeholders continuing to appropriately emphasize noxious weed detection and monitoring.

Gila NF managers also need to expand treatment options for managing native re-sprouting alligator juniper and evergreen oak species across the forest to include use of herbicide, where it is appropriate, while minimizing potential risks associated with its use. Herbicide use has the potential to increase treatment effectiveness and reduce treatment maintenance needs. In turn, the forest will realize an increase in cost-efficiency and pace of progress toward desired conditions for restoration and fuels reduction.

One of the primary goals of all vegetation treatments is to move toward ecological or urban interface desired conditions. However, there are times and places where movement toward desired conditions is short-lived due to the presence of re-sprouting species such as evergreen oak and alligator juniper. While these re-sprouting species are native, and an important component of many of the Gila NF's native vegetation communities, vegetation treatments that reduce canopy cover remove competition and create warmer conditions that favor them over other native species. Evergreen oak and alligator juniper almost always re-sprout from the existing root crown with more stems, and new plants germinate from the seedbank. This all results in a shift away from desired conditions for species composition and community structure, in addition to fuel composition and structure. Without frequent maintenance treatments, potential fire behavior becomes a firefighter and public safety concern, as well as an ecological concern, as subsequent fires are likely to perpetuate these conditions into the future.

Maintenance requirements within these vegetation communities, without using herbicide, currently exceed the forest's fiscal capability and add another limitation to the number of acres that can receive restoration treatments.

Herbicide is not currently available to the forest as a restoration tool, although it is frequently used on adjacent lands under other jurisdictions. The use of herbicide as a restoration tool is intended to contribute toward meeting desired conditions in the draft revised forest plan. More specifically, the purpose is to add herbicide to "the toolbox" as an available management tool with use being determined through an interdisciplinary process considering lessons learned and economics. The purpose is not to eliminate these native species or promote a total dependence on herbicide to attain or maintain desired conditions, but to have it available as an effective treatment method at the appropriate scale necessary to meet objectives.

Proposed Action

Plan-Level

The Gila NF proposes to revise its 1986 Land and Resource Management Plan (forest plan or 1986 plan) to provide strategic, program-level guidance for managing the forest's resources and uses over the next 10 to15 years. Proposed changes to the forest plan include incorporating resource desired conditions and management areas as well as updating objectives, standards, guidelines, suitability, and monitoring requirements. The draft forest plan changes the description and allocation of the management areas to move the majority of the land toward forest-wide desired conditions and provide opportunities for a range of activities. The proposed action (draft forest plan) focuses on the needs for change identified from the assessment (and listed in the above purpose and need for action section) and incorporates significant issues raised during the scoping and public engagement processes.

This proposed plan can be found electronically on the Gila NF website.

Herbicide Use

The proposed action for herbicide use would add the authority and guidance for integrated, cost-effective noxious weed management, fuels reduction, and restoration treatments. This is intended to support movement toward achievement and maintenance of desired conditions for ecosystems, watersheds, and the wildland-urban interface. Manual removal and herbicide treatments would be approved for noxious weed species forest-wide. Mechanical treatments are not authorized, as the degree of ground disturbance caused by those treatments would likely provide the advantage to noxious and other disturbance-adapted non-native plant species. Aerial application of herbicides would not be authorized for this proposed action. Both manual and herbicide treatments may need to be repeated to ensure that noxious and non-native invasive plant species are eradicated and controlled.

Noxious weed species qualifying for herbicide treatment would include all species listed on the most current Animal and Plant Health Inspection Service (APHIS), New Mexico Department of Agriculture (NMDA) or other state department of agriculture noxious weed lists, and yellow bluestem (*Bothriochloa ischaemum*). Although yellow bluestem is not currently on any of the considered noxious weed lists, the regional forester has recently requested NMDA to evaluate yellow bluestem (and Caucasian bluestem [*B. bladhii*]) for inclusion on the New Mexico State noxious weed list and has issued regional Forest Service guidance for its management, including recommendations for chemical treatment.

The proposed action would also authorize the use of herbicides on native, re-sprouting evergreen oak species and alligator juniper forest-wide. Wildland-urban interface areas are of particular concern with re-sprouting native woody vegetation. Treatments may need to be repeated if further re-sprouts are found after initial treatment. Herbicide use for restoration purposes would be tied to some kind of vegetation treatment, such as tree thinning, which would be a separate project-level NEPA analysis. While the herbicide use would already be NEPA-authorized should this alternative be selected, the NEPA analysis for a vegetation thinning project would include disclosure of the specifics related to herbicide use with the public, and in consultation with tribal governments, the U.S. Fish and Wildlife Service (USFWS), and the State Historic Preservation Office. There are also permitting and reporting requirements through the Environmental Protection Agency to fulfill section 402 of the Clean Water Act.

Whether for noxious weed management or restoration purposes, treatments that include herbicide use will contain project design criteria that limit the potential for adverse effects on non-target vegetation, soils, water quality, fish and wildlife, recreation opportunities, and human health. This proposed action does not propose to authorize aerial application methods; that authorization would require a separate analysis and decision. All other standard methods identified by label law[b] would be authorized. The project design criteria are:

- Integrated pest management will be used to prevent, control, contain, or eradicate noxious species to maintain or improve ecosystem and watershed function while minimizing treatment impacts on native species and human health. Chemical and biological methods of pest control will only be used when physical or cultural methods are unlikely to be successful.
- Application of any and all herbicides will be performed or directly supervised by a state or federally licensed applicator.

[b] Labels are legal documents providing directions on how to mix, apply, store, and dispose of a pesticide product. This means using a pesticide in a manner inconsistent with its labeling is a violation of Federal law. The label is the manufacturer's main way to give the user information about the product.

- All treatment projects that involve the use of herbicides will develop and implement pesticide-use plans that include transportation and handling specifications.
- Herbicide use will be restricted to those formulations containing active ingredients that have both an Environmental Protection Agency (EPA) and Forest Service risk assessment. To reduce the risk of synergisms or enhanced effects as a result of using more than one herbicide, mixtures of herbicide formulations may only be applied where the sum of all individual Hazard Quotients for the relevant application scenario is less than 1.0[c].
- Use only non-toxic adjuvants, such as surfactants or dyes, and inert ingredients included in Forest Service hazard and risk assessment documents.
- All application methods—except aerial methods—will be acceptable as permitted by the product label. All label instructions will be followed.
- To minimize or eliminate direct or indirect negative effects to non-target plants, animals, and water quality, follow the label and consult the risk assessment. Use site-specific soil characteristics, surface drainage patterns, proximity to surface water and local water table depth to determine the appropriate herbicide formulation, application timing and method, and if there is a need for buffers. Where herbicide is likely to be delivered to surface waters, only use herbicides registered for aquatic use.
- *For herbicide formulations not registered for aquatic use, the minimum buffer distances will be as follows:*
    - Class 0 herbicides, including aminocyclopyrachlor, aminopyralid, imazapic and imazapyr, do not require a minimum buffer.
    - Class 1 herbicides require a minimum buffer of 30 feet from surface water or wetland edge. These herbicides include chlorsulfuron, clopyralid, glyphosate, isoxaben, metsulfuron methyl, picloram, sulfometuron methyl, tebuthiuron, acid formulations of fluroxypyr and non-aquatic amine salt formulations of triclopyr.
    - Class 2 herbicides require a minimum buffer of 50 feet from surface water edge and at least 10 feet from riparian vegetation. These herbicides include dicamba, non-aquatic amine salt formulations of 2,4-D, and ester formulations of triclopyr.
    - Class 3 herbicides require a minimum buffer of 100 feet from surface water or wetland edge and at least 20 feet from riparian vegetation. These herbicides include ester formulations of 2,4-D.
    - For pool habitats, apply at least a 30-foot buffer from water's edge when there is no surface flow in and out of pool.

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[c] A hazard quotient is the ratio of the potential exposure to a substance and the level at which no adverse effects are expected. It is primarily used by US EPA to assess the health risks of air toxics.

A hazard quotient less than or equal to 1 indicates that adverse effects are not likely to occur, and thus can be considered to have negligible hazard. Hazard quotients greater than 1 are not statistical probabilities of harm occurring. Instead, they are a simple statement of whether (and by how much) an exposure concentration exceeds the reference concentration (Chem Safety Pro 2019).

- Loading or mixing of herbicides will occur at a minimum of 300 feet from live water and private residences.
- Backpack spray and boom/broadcast spray applications will use drift control agents to reduce the potential for drift to non-target species, food, and water sources.
- To reduce the risk of offsite and non-target impact, application will only occur under favorable weather conditions, as identified in the label instructions and in accordance with equipment manufactures specifications, all spraying will occur with winds less than 10 miles per hour and greater than 3 miles per hour, unless otherwise indicated in the label instructions.
- If there is a 50 percent or greater probability of local rain of at least 0.25 inch or more within 24 hours, then applications will only occur when it is anticipated that there will be sufficient time (at least four hours) for the application to dry before rainfall occurs.
- Granular herbicides will not be used on slopes greater than 15 percent due to the probability of runoff carrying the granules into non-target areas.
- When more than one herbicide may be suitable for a specific application scenario, the one with the lowest toxicity to wildlife should be selected unless there is information to suggest that doing so would promote the development of resistance to the lower toxicity herbicide in target species.
- Herbicides will only be used where they are deemed necessary to move toward desired conditions for vegetation communities and the urban interface. Where herbicide treatment is chosen, the rationale will be documented.
- Prior to implementing herbicide treatments, forest staff will ensure timely public notification. Treatment areas will be signed to inform the public and agency personnel of herbicide application dates and herbicides used. If requested, individuals will be notified in advance of spray dates.
- All treatment projects including herbicide use will be monitored for compliance with project design criteria and included in the biennial forest plan monitoring report.
- In designated and recommended wilderness areas, non-native, invasive species will be treated using methods and in a manner consistent with wilderness character to allow natural processes to predominate.
- Herbicide must not be sprayed within 100 feet of known rock art sites, caves, or rock shelters due to the possibility of perishable materials.
- All timing stipulations, terms and conditions, reasonable and prudent measures, buffers, or avoidance areas identified through consultation efforts (i.e., Tribal, Section 106, and Section 7) and site-specific analysis will be integrated into project application scenario.

All 21 herbicides registered through the EPA and for which there is a Forest Service risk assessment would be authorized. This excludes the five herbicide with limited-use risk assessments that the agency has identified for specific nurseries or wildlife food plots. A list of these herbicides and their risk assessments is provided in appendix K. Decision Framework

Plan-Level

The forest supervisor of the Gila NF will ultimately make the final decision on the selected alternative for the proposed revised forest plan. The forest supervisor will review the proposed action (alternative 2, proposed revised forest plan), other alternatives (1, 3, 4, and 5), and the environmental consequences of each, and then decide which f alternative, or combination of alternatives, best addresses the identified needs for change, issues raised during the scoping process, desired conditions, multiple use concept, diverse needs of people, sustainable resource management, as well as the requirements of the National Forest Management Act (P.L. 94-588) and the Multiple Use-Sustained Yield Act (P.L. 86-517).

Based on analysis in this DEIS and subsequent public comments, the responsible official will separate the plan and project-level analyses. A final environmental impact statement (FEIS) and a draft record of decision that identifies the selected alternative will be prepared and subject to an objection process guided by direction in 36 CFR Subpart B (219.50 to 219.62). A final record of decision and accompanying forest plan will set a course of action for managing the forest for the next 10 to 15 years. Project-level environmental analysis will still need to be completed for specific proposals to implement forest plan direction.

Herbicide Use

The forest supervisor for the Gila NF will make the final decision on the selected alternative for the revised forest plan before making a decision on the herbicide alternatives. After the final plan-level decision is made, the forest supervisor will go through a similar but separate process on the use of herbicide as was described above for the plan-level decision making framework, and select the alternative that best supports movement toward desired conditions and sustainable management of the forest.

Public Involvement

Plan-Level

Recognizing that our partners and the public have valuable ideas, knowledge, opinions, and needs that can inform and improve management of the Gila NF, a variety of opportunities for meaningful dialogue and collaboration were provided throughout the plan revision process. While revising the forest plan, the Gila NF has hosted or participated in approximately a hundred different meetings and outreach activities with a wide variety of styles and audiences with hundreds of participants since 2015.

- **Information booths**. The Gila NF raised awareness for plan revision by contacting hundreds of members of the public through outreach since 2015, by setting up informational booths at county fairs, New Mexico State Fair, Outdoor Expo, Silver City Blues Festival, Mimbres Harvest Festival, National Hunting and Fishing Day, and other public events.
- **Other organization meetings**. The Gila NF made presentations on plan revision at over 35 governmental and non-governmental organizations meetings at the request of those self-convening groups.
- **Local Government meetings**. Briefings were provided to Catron, Grant, Hidalgo and Sierra County Commissions starting in 2015. Gila NF staff also attended regular meetings of the Southwestern County Commission Alliance.

- **Community Meetings**. Multiple rounds of meetings were held in the communities of Glenwood[d], Las Cruces, Quemado, Reserve, San Lorenzo/Mimbres[d], Silver City, and Truth or Consequences. These meetings were often facilitated by a neutral, third-party contractor.
  - The first round, which took place in winter 2015, introduced forest plan revision concepts, and identified expectations, opportunities, and methods for communication and engagement.
  - The second round, which occurred in summer 2015, provided opportunities for stakeholders to share knowledge, plans, and data for the assessment.
  - The third round, which took place in fall 2016, involved assessment key findings, identifying current plan needs for change, and continued the dialogue between Gila staff and nearby residents, forest users and interested individuals.
  - The fourth round, which occurred in spring 2017, helped create a shared understanding of desired conditions in the Gila and other plan components, while providing an opportunity to learn about and contribute input on the next steps in the forest plan revision process.
  - The fifth round, which occurred in spring 2018, provided an opportunity to provide feedback on the preliminary draft plan.
  - At the sixth round, which occurred in fall 2018, stakeholders discussed how significant issues (or issues that are important to the community) are reflected in the preliminary range of alternatives, with the opportunity to provide feedback and additional suggestions.
- **Technical Meetings**. Seven extended technical meetings were held in 2017 and 2018, to allow more in-depth discussion by interested local governments, State and Federal agencies, non-governmental organizations, and the public on stakeholder-suggested topics. These technical meeting topics included multiple uses, riparian/watershed, designated areas, sustainable infrastructure, local economies, monitoring, and vegetation management tools. These meetings were often facilitated by a neutral, third-party contractor.
- **Desired Conditions Workshop and Fieldtrip**. Gila staff, in cooperation with partner agencies and organizations, held a workshop in August 2017, to discuss the science supporting desired conditions, management activities, opportunities, and challenges for frequent-fire forest ecosystems.
- **Open Houses**. Open Houses were held to provide informal opportunities for the public to stop by the office to ask questions and have conversations with planning team members.
- **Youth outreach**. On-line and interactive classroom sessions to engage youth and educators were conducted by Dr. Kathy Whiteman of Western New Mexico University.
- **Underrepresented communities**. Meetings were held in areas with high economic and ethnic diversity. Flyers and major documents were translated into Spanish, and a bilingual planning team member was available at community meetings to translate and engage in conversation.
- **Gila Symposium**. The Gila NF and the Southwestern Regional Office participated in the 6th and 7th Natural History of the Gila Symposiums hosted by Western New Mexico University.
- **Contact list**. Through all these outreach activities, stakeholders had the opportunity to sign up to be on the forest plan revision contact list. The contact list (email and hardcopy) is now at

[d] Glenwood and San Lorenzo/Mimbres did not always have a community meeting each round due to time or funding constraints.

over 1,000 people, which, for a rural area, captures many of those who are interested in resource issues in the forest. Regular updates have been sent to the contact list to highlight opportunities to be informed and engaged in the revision process.

Tribal consultation and collaboration have been ongoing since 2015. The Gila NF maintains a governmental relationship with 10 federally recognized Indian Tribes (Pueblos of Acoma, Laguna, Zuni, Ysleta Del Sur Pueblo, the Navajo Nation, the Hopi Tribe, the San Carlos Apache Tribe, the Ft. Sill Apache Tribe, the Mescalero Apache Tribe, and the White Mountain Apache Tribe), also directly contacting specific bands within those tribes that live nearby. All of these groups have been contacted by mail and by phone in regards to forest plan revision. Face-to-face consultation has occurred with six tribes. These conversations have led to a growing understanding of their vision of how we can best partner with them and how this landscape should best be managed into the future. The forest plan revision process is a unique opportunity for tribes to influence the long-term vision for the Gila NF and to strengthen the unique government-to-government relationship that the forest values with the tribes. The Gila NF also participated in two regional tribal roundtables held by the Southwest Regional Forester. These discussions brought together all of the national forests in New Mexico to discuss, learn, and collaborate with tribes around forest plan revision.

Involving tribal, Federal, State, and local government entities in the planning process provides a forum for enhancing the collective voice and interests of the communities and greater public around the national forest. In addition to the engagement opportunities described above, letters were sent to government entities in June 2017, describing coordination and cooperating agency opportunities. As part of coordination, the Gila NF requested management plans and reviewed planning and land use policies of tribes, other Federal agencies, and State and local governments to understand and consider those entities' objectives. The purpose of coordination is to foster greater recognition and discussion of issues that have cross-boundary effects, to look for common objectives and solutions, and to find opportunities to integrate management across landscapes. An additional avenue for participation that is potentially available to governmental entities is serving as a cooperating agency to lend technical assistance or other resources to the development of the revised forest plan. Three agencies are cooperating agencies for the forest plan revision: New Mexico Department of Agriculture, New Mexico Department of Game and Fish, and San Francisco Soil and Water Conservation District.

The notice of intent to prepare an EIS was published in the Federal Register on April 26, 2017. The notice of intent asked for public comment on the proposal through June 12, 2017; however, the forest considered substantive comments that were received after this date. The comments received were used to modify the proposed plan and develop alternatives. There have been other opportunities to provide input or feedback on the following: assessment material, draft assessment report, draft need for change statements, preliminary draft plan, draft wilderness inventory process paper, draft wilderness inventory map, draft wilderness evaluation process paper, draft wilderness evaluation report, wilderness analysis information, and wild and scenic river eligibility study process paper.

There will be additional opportunities for public involvement in the NEPA review and forest plan revision processes. Concurrent with the release of this DEIS, a notice of availability, published in the Federal Register initiates the formal 90-day comment period on the DEIS and proposed forest plan as required by Forest Service NFMA regulations at 36 CFR 219. The formal 90-day comment period is another opportunity for commenters to gain eligibility to object to the forest supervisor's ultimate decision regarding the selected alternative. There will also be multiple community meetings across the Gila NF following the release of the Draft Plan and DEIS.

For more details, see Appendix E: Documentation of the Public Engagement Process and Coordination with other Public Planning Efforts.

Herbicide Use

There have been discussions with stakeholders throughout the plan revision process on current conditions, desired conditions, vegetation management challenges, and tools available to meet desired conditions. At our assessment community meetings, when asked about conditions, trends, and risks, stakeholders identified the increased density of woody vegetation and presence of invasive plants as key challenges. At a technical meeting to discuss vegetation management tools such as mechanical, fire, herbicide, and biological, stakeholders were asked to provide input on the advantages, risks or concerns, and ways to mitigate those risks and concerns. Stakeholder input from the technical meeting, as well as other meetings, was used to develop the proposed action and alternatives.

Issue Identification

Plan-Level

The local governments, agencies, organizations, and the public submitted comments in response to the notice of intent and preliminary draft plan. Comments were analyzed to identify issues and frame their associated relationships. This led to better understanding of multiple perspectives, areas of alignment or potential alignment, and areas of disagreement. Areas of agreement were able to be incorporated into the draft plan and every alternative. However, there are a handful of issues where there were multiple perspectives on a change in plan direction.

Issues serve to highlight effects or unintended consequences that may occur from the proposed action or alternatives, giving opportunities during the analysis to reduce adverse effects and compare tradeoffs for the decision maker and public to understand (FSH 1909.15 section 12.4). The following items represent issues that were identified as significant during the iterative development of the draft plan and led to development of alternatives 3, 4, and 5 (see chapter 2 for more information).

Methods for Restoring Vegetation: Overall, comments supported the need to move vegetation toward desired conditions that are more healthy and resilient to anticipated future changes. However, opinions differed on the means to achieve it. Some wanted the Forest Service to use more mechanical methods (i.e., logging and thinning), while others desired an approach relying on natural processes such as wildland fire.

Vegetation Types to Focus Restoration Efforts On: When the Gila asked stakeholders about conditions and trends that people had observed in the forest, people overwhelmingly said “there’s more woody vegetation than before.” This is especially prevalent with woody species infill in woodlands and forests, and encroachment in grasslands and other gaps and openings. Several vegetation types are departed from desired conditions. However, funding, workforce, and industry capacity may constrain the forest’s ability to achieve desired conditions everywhere through restoration. Due to people dissatisfied with the rate of progress, the Gila received comments to prioritize on the grasslands and open woodlands to the exclusion of other types. Still others wanted the forest to focus on the forest/timberland vegetation types to the exclusion of other types.

Riparian Management: Riparian areas are affected by the presence of water and are composed of distinctively different vegetation and higher productivity, compared to adjacent areas where water is more limited. As a result, these areas are a focal point for humans, wildlife, and livestock activities.

Riparian areas are adapted to disturbance and defined by change; however, they are susceptible to degradation and loss, and have varying perspectives on their management. Some urged keeping livestock grazing in riparian areas, but using adaptive management and best management practices to move toward and/or maintain desired conditions. Others wanted to phase out grazing in riparian areas and increase the distance buffered from new road construction.

Livestock Grazing: There are varying opinions on the amount of flexibility for livestock management. Some wanted to increase flexibility of livestock management with fewer strict standards and more guidelines in the plan. While others wanted to decrease flexibility of livestock management with more strict standards and less guidelines in the plan.

Vacant Allotments: There are 10 vacant allotments out of the 138 active grazing allotments, or 8 percent. There was a wide variety of opinions about what to do with the vacant allotments. Some would like to see permits issued for all the vacant allotments so that all the allotments are fully stocked and there are no vacant allotments in the future. Others would like to use some of these vacant allotments to increase management flexibility and allow current permit holders to use during times of need like drought years, before or after fire, or to avoid livestock-wildlife conflicts. Still others would like to see the vacant allotments kept vacant and unused or even removed from grazing for wildlife and watershed purposes.

Lands: Since the Gila NF was established, numerous land transactions have added and subtracted portions of the land area, via land exchanges, purchases, donations, and sales. Peak Facilitation, a contracted facilitation company, conducted a websurvey in February 2017, to gather stakeholder thoughts on how the forest should conduct these land adjustments in the future. The results of the websurvey showed differing opinions. Some thought that the forest should acquire desirable lands for public access and resource management when available, and when possible, dispose of isolated, unmanageable lands or lands that support community development. Others felt that more emphasis should be directed toward land exchanges so that no net loss of private property value in a county occurred.

Group Size and Length-of-Stay Limits in Wilderness: To protect the wilderness characteristic of opportunities for solitude or primitive and unconfined recreation, the 1986 forest plan and preliminary draft revised plan contained group size and length-of-stay limits in wilderness. Some felt that the revised group size and length-of-stay limits were too restrictive, and that backcountry behavior (e.g., traveling techniques, Leave No Trace principles, etc.) is a more important variable than group size in determining a group’s social and ecological impact.

Amount of Recommended Wilderness: Each national forest undertaking forest plan revision is required to identify and evaluate lands that may be suitable for inclusion in the National Wilderness Preservation System. The four-step process concludes with a determination about whether to recommend any of the evaluated lands to Congress for wilderness designation. There were divided opinions as to whether to recommend more wilderness. Some people desired no additional wilderness, while others wanted a significant amount of new recommended wilderness, while still others wanted some new recommended wilderness taking into consideration other forest uses and restoration needs.

Amount of Other Designated Areas: There are other types of designations open for consideration during forest plan revision to maintain unique special characters or purposes across the landscape. The Gila received proposals to recommend other designations around the forest, specifically botanical areas. Others would like to see no additional designated areas.

Herbicide Use

Public comments and concerns received during the plan revision process and the Luna Landscape Restoration Project contributed to development of the herbicide use proposed action and alternatives. The following items represent issues that were identified as significant during the iterative development of the draft plan and led to development of alternatives C and D (see chapter 2 for more information).

Herbicide Effects on Human Health: Some stakeholders are concerned about potential human health impacts that may result from exposure to herbicides. Exposure to herbicides can be direct or indirect. Applicators may experience direct exposure during application if they are not wearing the appropriate personal protective equipment. Forest visitors may experience direct exposure walking through a recently treated area. Indirect exposure can occur as a result of gathering vegetation that has been sprayed for some type of use or by drinking contaminated water. Some people gather plants found on the forest for ceremonial purposes, food and medicine, home decoration or artistic purposes.

Herbicide Effects on Wildlife and Fish: Some stakeholders are concerned about the effects of herbicide on terrestrial and aquatic wildlife species and fish. Mammals, birds, amphibians, reptiles and fish and other species could be exposed to herbicides by ingesting herbicides residing on plants, in the soil, or in water. Predators may also be exposed by ingesting prey species that have ingested herbicides. Concerns about herbicide effects on habitat quality and prey species have also been expressed.

Herbicide Use on Native Plant Species: Some stakeholders support the use of herbicide to control the density of native plant species such as alligator juniper, but others have expressed concerns. Concerned stakeholders assert that herbicide use is a dangerous continuation of past failed management approaches. Specifically, they assert that herbicide use on native species such as alligator juniper is treating a symptom, not the cause, which they believe to be the failure of livestock grazing management.

Herbicide Effects Non-target Native Plant Species: Other stakeholders are concerned about native plant species that are not the target of herbicide treatments, but may be exposed by drift, runoff or leaching of herbicide.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes each alternative considered for the revision of the 1986 plan and herbicide use. From the issues identified in chapter 1, a range of alternatives was developed that represent different perspectives. This range of alternatives represents different ways of managing the forest often grouped by theme on a variety of issues. This range gives opportunities during the analysis (chapter 3) to compare trade-offs and effects between the alternatives for the forest supervisor and stakeholders to understand. It also presents the alternatives in comparative form, describing the differences between each and providing a basis for choice among options for the responsible official (forest supervisor). The forest supervisor r will make a reasoned choice among alternatives based on the analysis.

Plan-Level Alternative Development

Alternatives Considered in Detail

The following discussions of each alternative provide a general sense of how the issues identified in chapter 1 drove alternative development. Greater detail about the differences between alternatives is provided at the end of this section in the comparison of plan-level alternatives (table 1).

Alternative 1 is the no-action alternative to continue using the 1986 forest plan. However, the desired conditions for vegetation in the draft revised forest plan are superimposed over the no-action alternative. This is done at the discretion of the Regional Office for every forest plan revision effort in Arizona and New Mexico to maintain consistency. Additionally, the timber suitability analysis process replaces the analysis supporting the 1986 plan per the NFMA. The new wild and scenic river eligibility study also replaces the previous eligibility study and remains the same under all alternatives (FSH 1909.12 Chapter 80).

Alternative 2 (proposed action) is to implement a revised forest plan developed iteratively in a collaborative manner to address the need for change. In June 2017, the Gila NF held community meetings to receive input on desired conditions and priority ecosystem services. Based on this input, the Gila released a preliminary draft plan for review and feedback in March 2018. These collaborative efforts between the Forest Service and external groups and individuals led to development of the proposed plan (alternative 2). In September 2018, community meetings were held to receive feedback on the preliminary range of alternatives. Three additional alternatives (alternatives 3, 4, and 5) were generated based on issues not addressed by the proposed plan. These issues are listed in chapter 1 under the section “Issue Identification.”

The proposed action aims to restore a variety of grasslands, open woodlands, and forests using a combination of naturally ignited wildfire, prescribed fire, and mechanical methods to maintain or move toward desired conditions. Management activities and permitted uses would maintain riparian management zones in, or trending toward proper functioning condition. There are a mixture of standards and guidelines for livestock grazing plan direction. Vacant allotments would be considered for use by holders of a current permit during drought years, before or after fire, and to avoid conflicts between livestock and wildlife. Lands adjustments enhance public access and use, and support resource management objectives and community development. The default group size limit in wilderness would be 15 persons and 25 head of pack and saddle stock, although exceptions can be granted by the forest supervisor on a case-by-case basis. Some new recommended wilderness areas are proposed, taking into consideration other forest uses and restoration needs. Also recommends new botanical and research natural areas.

Alternative 3 was developed to respond to issues by placing more emphasis on mechanically treating grassland and open woodland vegetation to maintain or move toward desired conditions for those vegetation types. These efforts would prioritize restoring understory vegetation that could be used as forage for livestock grazing, which contributes to local and regional economic sustainability. The use of fire would be limited. Management activities and permitted uses would maintain riparian management zones in, or trending toward proper functioning condition. Emphasizes guidelines rather than standards for livestock grazing plan direction. Vacant allotments are stocked to the maximum extent possible. Land adjustments would be balanced so that no-net loss of private property in a county occurred. Outfitter-guide operating plans would include appropriate wilderness practices, follow Leave No Trace principles, and incorporate awareness for wilderness values into their guide trainings and client interactions. If other management strategies are ineffective, group size limits may be established in the operating plan where needed. Wilderness recommendations are not made in areas identified as needing restoration in grassland and open woodland vegetation and providing access to traditional recreational, cultural, and historical uses of the forest.

Alternative 4 was developed to respond to issues by placing more emphasis on mechanically treating forested or timberland vegetation to maintain or move toward desired conditions. These efforts would prioritize restoring forested vegetation that could also produce forest products, which contributes to local and regional economic sustainability. The use of fire would be limited. Management activities and permitted uses would maintain riparian management zones in, or trending toward proper functioning condition. Guidelines rather than standards are emphasized for livestock grazing plan direction. Vacant allotments are stocked to the maximum extent possible. Land adjustments would be balanced so that no-net loss of private property in a county occurred. Outfitter-guide operating plans would include appropriate wilderness practices, follow Leave No Trace principles, and incorporate awareness for wilderness values into their guide trainings and client interactions. If other management strategies are ineffective, group size limits may be established in the operating plan where needed. Wilderness recommendations are avoided in areas identified as needing restoration in forested vegetation or being suitable for timber production and providing access to traditional recreational, cultural, and historical uses of the forest. This alternative identifies more land suitable for timber production and would offer more wood products.

Alternative 5 was developed to respond to issues by placing more emphasis on natural processes (use of wildland fire) as a restoration tool to maintain or move toward desired conditions for a combination of grassland and open-canopy woodlands, and forest types. Mechanical treatments would be largely limited to the wildland-urban interface. Riparian areas containing perennial streams or native trout populations or Mexican spotted owl would have an increased buffer from new construction or realignment of roads. Standards rather than guidelines are emphasized for livestock grazing plan direction. Vacant allotments would not be used as a forage reserve. For allotments without current NEPA analysis whose permits have been waived back to the government without a preferred applicant, the allotment would remain vacant and unstocked until site-specific NEPA analysis is completed to evaluate condition (e.g., any restoration needs) and issues (e.g., any wildlife conflicts) and to determine future management and uses. Lands adjustments enhance public access and use, and support resource management objectives and community development. The default group size limit in wilderness would be 15 persons and 25 head of pack and saddle stock although exceptions can be granted by the forest supervisor on a case-by-case basis. This alternative recommends more acreage for wilderness and other designations such as new botanical and research natural areas.

Elements Common to All Alternatives

All five alternatives share a number of features. In particular they all:

- Comply with applicable laws, regulations, and policies
- Contain plan decisions including desired conditions, objectives, standards, guidelines, timber suitability, and monitoring;
- Desired conditions are common across all alternatives[e] and are described in detail in the draft forest plan;
- Provide sustained multiple uses, products, and services in an environmentally acceptable manner (including forest products, livestock forage, recreation opportunities, and leasable and locatable minerals);
- Conserve soil and water resources and do not allow significant or permanent impairment of the productivity of the land;
- Provide management direction for riparian areas;
- Maintain air quality that meets or exceed applicable Federal, State, and local standards and regulations;
- Provide for and maintain diversity of plant and animal communities to meet overall multiple-use objectives;
- Provide for species' viability by providing appropriate habitat that is well distributed across the planning area;
- Use a common list of species of conservation concern (SCC). The SCC were selected based on regional guidance and recommendations from Federal and State agency specialists and other stakeholders;
- Recognize and respect the unique status of Native American tribes and their rights conveyed by trust and treaty with the United States, including consultation requirements;
- Recognize the value of traditional and cultural uses and their relationship to the Gila NF;
- Protect cultural resources;
- Mitigate risks to firefighters and the public during responses to wildland fire, risks to firefighters and the public are mitigated, because protection of human life overrides all other priorities;
- Retain existing designated areas (e.g., wilderness areas, research natural areas); and

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[e] Desired conditions (or goals) that apply to all of the Gila NF include descriptions of desired outcomes as a result of Forest Service management. The desired conditions are described in detail in the proposed revised plan (alternative 2), and are the same for alternatives 3, 4, and 5. While these desired conditions are used to analyze environmental consequences, alternative 1 provides its own set of stated goals and desired conditions.

- Based on the completed 2019 eligibility study, have 16 stream reaches (225 miles) that are eligible Wild and Scenic Rivers.

Elements Common to All Action Alternatives

Alternatives 2, 3, 4, and 5 also share a number of features. In particular, they all:

- Increase guidance on fostering relationships and developing opportunities to leverage partnerships and collaboration, and enhance communication;
- Promote ecological restoration and resilience;
- Sustainably manage watershed condition and integrate best management practices;
- Provide direction on integrated pest management and provide plan direction on the use of pesticides for restoration;
- Emphasize sustainable recreation and increase guidance on implementing a sustainable recreation program for the Gila's niche;
- Update plan direction for the sustainable infrastructure, road maintenance prioritization process and decommissioning of unneeded roads that accounts for budgets and resource needs and constraints, but also involves affected stakeholders;
- Use the Scenery Management System and Recreation Opportunity Spectrum to consider scenery and recreation opportunities when planning projects;
- Provide direction for fuels reduction treatments and maintenance of vegetation for those areas of resident populations at imminent risk from wildfire, as well as human developments having special significance;
- Include management approaches for education and communication of policies regarding recreational mining and non-commercial rock and mineral specimen collection activities; and
- Provide a comprehensive updated monitoring plan.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by the NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the proposed action and preliminary draft plan provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives are outside the scope of the plan revision process; already decided by higher law, regulation or policy; or already addressed by the alternatives considered in detail. The following alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

Alternatives that eliminate livestock grazing

Eliminating livestock grazing would not meet the Gila NF's need for change for revising the forest plan. A no-grazing alternative would not meet legal direction that forests will be managed using multiple use and sustained yield principles per the National Forest Management Act and Multiple Use-Sustained Yield Act. This alternative also would not allow the attainment of the desired condition for livestock grazing to contribute to the long-term socioeconomic diversity, stability, and cultural identity of local communities. Therefore, a no-grazing alternative is inconsistent with existing laws, Forest Service policy and direction, as well as the forest plan's desired conditions.

There was also a suggestion to phase out grazing from the wilderness, but livestock grazing is directed by Congress to continue where it occurred prior to wilderness designation under the Wilderness Act of 1964.

Under all alternatives, the rangelands management and livestock-grazing program has multiple mechanisms to evaluate, review, and adapt management as needed to effectively conserve resources and respond to changing conditions. Stocking decisions regarding the amount of livestock grazing authorized for each grazing allotment are considered as part of project-level analysis (NEPA). Project-level analysis would cover changes to authorized grazing through term grazing permits (subject to forest-wide standards and guidelines); allotment management plans; and annual operating instructions.

Using alternative E from the 1996 Amendment of Forest Plans in Arizona and New Mexico

There was a suggestion to use alternative E from the Southwestern Region revision of 11 forest plans (including the Gila) in 1996 for northern goshawk, Mexican spotted owl, and old growth standards and guidelines. Alternative E was originally developed by Applied Ecosystems Inc., and includes standards and guidelines related to forest health, desired forest condition, assessment and planning function, implementation function, monitoring function, Mexican spotted owl, northern goshawk, wildlife cover, and allocated old growth (USDA FS 1996). Some of the broader guidance within this alternative is generally consistent with other alternatives developed as part of the plan revision process, including specific direction for northern goshawk, which is reflected in the proposed desired conditions for vegetation. However, other specific characteristics prescribed in alternative E rely on outdated information regarding reference landscape descriptions, vegetation characteristics (e.g., canopy cover and openness), old growth and wildlife recovery and management plans.

Alternatives outside the historic range of variation

Some stakeholders commented that the Forest Service can no longer manage to a historic range of variability for vegetation due to climate change, but instead suggested managing for resiliency, although without many details on how this was to be accomplished. Similarly, there was another suggestion to manage for carbon storage above the historic range of variability. However, the science indicates this is not sustainable. Higher levels of carbon storage become a wildfire liability, leading to large emissions pulses and a decline in the capacity of the ecosystem to store carbon over the long term.

The 2012 Planning Rule promotes the management of ecological integrity (while also contributing to social and economic sustainability), which is defined by the dominant ecological characteristics occurring within the natural range of variation and ecosystems that can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence. The developed alternatives include historic range of variability and resiliency guidance consistent with the 2012 Planning Rule, while also incorporating management approaches to climate change and uncertainty. Plan direction also facilitates in building ecosystem resilience through desired conditions, objectives, and monitoring. Ecosystem resilience and adaptive capacity is expected to be achieved through the restoration of vegetation structure, vegetation composition, and appropriate fire regime processes to ecosystems in the Gila NF.

Suggested suitability, standards, and guidelines considered but not analyzed in detail

Commenters requested additional suitability, standards, or guidelines to those proposed in the plan, or suggested increasing or decreasing the use of standards to minimize or increase flexibility and resource protection during plan implementation. The forest carefully considered the suggested changes to standards and guidelines, and modified the draft forest plan where appropriate. Increased and decreased resource flexibility and resource protection are largely reflected in the five alternatives being analyzed in detail.

Road density standard

Comments suggested including a motorized route density standard of generally less than one mile per square mile. This standard was considered, but not analyzed in detail because recent site-specific analysis and decisions have been made in the forest that identified the open motorized road system during the travel management process. Under the travel management process, alternatives were developed and analyzed based on issues including the effects on wildlife, sedimentation, and erosion. The resulting decisions were based on a collaborative process and scientifically based information.

Suitability studies

Comments were received requesting that the Gila NF do a suitability analysis as part of the draft forest plan for mineral and energy development, restoration-focused vegetation management, motorized vehicle use, energy development, road building, and other forest uses or activities. Suitability addresses which specific lands within the forest plan area will be identified as suitable or not suitable for various projects and activities, based on legal and technical factors. The suitability of lands need not be identified for every use or activity except in the case that every plan must identify those lands that are suitable and not suitable for timber production. At the discretion of the forest supervisor, the Gila NF is only doing timber suitability for this plan revision, with other uses being addressed with standards and guidelines.

Prohibition of certain restoration methods

There was a suggestion to prohibit use of prescribed fires as a vegetation management tool with the goal of reducing smoke-related impacts to air quality in surrounding communities. Vegetation management would rely solely on mechanical means; however, this prohibition was not considered in detail because it is inconsistent with promoting natural disturbance regimes and ecological integrity. All alternatives considered in detail include direction to meet State and Federal air quality standards and minimize smoke impacts to the public. Another suggested prohibition was to no longer use chemical piscicide and only use mechanical removal of non-native fish species; however, mechanical removal is not feasible or reliable.

Permanently exclude livestock grazing from all riparian management zones

There were suggestions to permanently exclude livestock grazing from all riparian management zones. This suggestion was considered, but not analyzed in detail because it is not fiscally feasible, based on reasonably foreseeable budgets due to the amount of fencing material and labor, and maintenance that this would entail. Streams in the Gila NF provide essential habitat for many aquatic, terrestrial, and riparian species, and in many cases, water for livestock. Some riparian areas in the Gila NF are inaccessible to livestock due to natural barriers, or excluded by fencing on a case-by-case basis due to resource concerns and previous litigation. Exclosures can be one of several effective management strategies to help move degraded riparian areas toward proper functioning condition, but they are not necessary in every case. Streams are evaluated during range analysis using the proper functioning condition protocol (Prichard et al. 1998). These assessments are accomplished during the range analysis process. Overall, these assessments depict improving trends across the forest's riparian areas (Natharius 2019). As of 2015, an estimated 10,639 acres of riparian were excluded from livestock grazing, including roughly 210 acres of springs and wetland areas, and 825 acres of riparian pastures had been created to better manage livestock. These exclosures were primarily created due to conditions in threatened and endangered species' habitats in consultation with the USFWS based on proper functioning condition assessments or field observations by Forest Service and/or USFWS personnel although maintenance and monitoring of the exclosures are ongoing issues.

Prioritize the removal of "feral" cows

There were suggestions to create a plan standard prioritizing the removal of what are colloquially called "feral" cows. This suggestion was considered, but not analyzed in detail because the forest plan cannot solve the feral cow problem. While one of many management priorities, solving the problem requires coordinating and collaborating with the New Mexico Livestock Board, which means it has to be their priority as well.

Length-of-stay limit in wilderness

There was a suggestion that permitted outfitters, operators who are pursuing an educational outcome, or permittees who provide progressive expedition-style trips, should not be subject to any length of stay limit for wilderness established by plan direction. Another suggestion was that dispersed campers may be allowed to remain in the forest for longer than 14 days, but not more than 30 days, if they do not remain in any one camp for more than 3 days and do not return to previous campsites on the same trip. These suggestions were considered, but not analyzed in detail because there have been efforts to make the length of stay limits more consistent across the Region (and other nearby forests have similar lengths of stay limits). And, the draft plan language exempts people with special-use permits or other written permission from the forest supervisor or designated agent authorizing longer stays than the limit taking into consideration agreement to mitigation terms and demonstration of a high proficiency for Leave No Trace ethics. An operating plan is an extension of the special-use permit. Changes can be made to the default length of stay limits for any individual wilderness when approved by the forest supervisor and informed by recommendations from analysis of effects to wilderness character completed by an interdisciplinary team.

Suggested management areas considered but not analyzed in detail

Management areas are delineated areas with a common set of plan components that differ from forest-wide plan components and are established to meet specific management needs. A subset of management areas are designated areas that represent identified exceptional areas that have distinct or unique characteristics that warranted special designation through statute or administrative process.

Include all lands in the inventory as a recommended wilderness

The Gila NF considered, but did not include an alternative based on the comment to include all inventory areas as recommended wilderness. There is no requirement in the 2012 Planning Rule for all lands included in the inventory and subsequent evaluation to be carried forward in an alternative (FSH 1909.12, Ch 70.73). The planning rule requires that the responsible official identify which specific areas or portions thereof, from the evaluation to carry forward as recommended wilderness in one or more alternatives to be analyzed for effects. Additionally, not all lands in the wilderness inventory have wilderness characteristics, meaning they can be excluded from further evaluation under the 2012 Planning Rule. Some areas might benefit from active management that would be more efficient and effective if mechanical options were available.

After completion of the inventory and the evaluation to determine what areas have wilderness characteristics, the responsible official selected only those areas that had wilderness characteristics to be considered for analysis. These areas were then considered for how they best met the intent of each alternative.

Designate 20 percent of ecosystems as recommended wilderness areas

A comment was received to include 20 percent of all ecosystems in the Gila NF that are "underrepresented" (less than 20 percent) in all wilderness throughout the United States as potential recommended wilderness to adequately protect ecosystem integrity and diversity. This designation was considered but not analyzed in detail. The proposed plan addresses promoting ecosystem integrity and diversity through other plan components. The forest supervisor and staff do not agree that recommendation as wilderness is always the best management tool for this goal and believe this approach would not be consistent with the process as outlined in handbook direction (FSH 1909.12 Chapter 70).

Create management area for critical habitat within the forest plan

There was a suggestion to include critical habitat as a management area in the draft forest plan. The authority to designate critical habitat is with the Director of the USFWS. The draft plan does include a guideline that management activities occurring within federally listed species' occupied, designated, or proposed critical habitat should implement the most recent approved USFWS recovery plan and integrate habitat management objectives and species recovery, conservation, and protection measures identified in the plan. This general reference to the designated or proposed critical habitat within the guideline ensures the intended continued implementation of recovery plans without repeated amendments to the forest plan compared to if the critical habitat was specifically listed in the forest plan for each species that required amendments when there were changes to critical habitat.

Create conservation watersheds

Another suggestion was to identify and designate a network of conservation watersheds designed to protect and restore aquatic and riparian habitat in the forest. This suggestion was considered, but not analyzed in detail. Conservation watershed networks are allowable under the 2012 Planning Rule, but are not required. Given draft forest plan components must provide for maintaining or restoring ecological integrity for aquatic and riparian habitats, and recovery plans for listed species will be implemented under any alternative, forest staff believe establishing conservation watershed networks would add unnecessary structural complexity to the plan and analysis, but would not change the outcomes of management.

Create management area for wildlife corridor network

There was a suggestion to create a management area for a wildlife corridor network. This suggestion was considered, but not analyzed in detail as the draft forest plan and alternatives provide for wildlife connectivity consistent with the 2012 Planning Rule. The specific plan components in the draft forest plan that address wildlife connectivity can be found in appendix D. It is undetermined what the major barriers to wildlife movement are in the large, contiguous Gila NF situated in a relatively unfragmented landscape although there is some recent modeling on a limited number of species that address connectivity off Federal lands between other national forests in New Mexico (Wan et al.

2018). In the near term, managing ecosystems toward desired conditions should provide for the maintaining habitat connectivity and species biodiversity across the forest but, providing for connectivity over the long term will likely require a broader-scale, multi-jurisdictional collaborative effort outside of the forest plan process. The forest seeks opportunities to work with interested partners and stakeholders in such a collaborative and incorporate climate-informed connectivity models into decision-making.

Create management area for roadless lands

There was a suggested management area focused on backcountry restoration and recreation designed to protect roadless, non-motorized recreation, habitat, and other social and ecological values associated with the Gila's complex of roadless lands. This suggested management area was considered, but not analyzed in detail because it is duplicative of existing IRAs established under the 2001 Roadless Area Conservation Rule (36 CFR Part 294). Approximately 22 percent of the Gila NF's land mass (733,836 acres) is already located within 29 individual IRAs.

Create alternate Continental Divide Trail routes

There were suggestions to create alternate Continental Divide Trail routes. This suggestion was considered, but not analyzed in detail because it is not within scope of the draft forest plan as the trail corridor is legislatively determined or modified by Congress. Any proposed changes may be submitted as a citizens' proposal and addressed at project level, or submitted as a citizens' proposal directly to Congress.

Create special management areas for some inventoried areas not recommended for wilderness designation

There was a suggestion to create special management areas to maintain ecological conditions, wildlife connectivity, roadless characteristics, and other values of inventoried areas not recommended for wilderness designation. This suggestion was considered, but not analyzed in detail because there were no specifics provided as to how these areas should be managed differently or in addition to other proposed plan direction to align with identified desired conditions, goals and objectives, and fulfil existing mandates to comply with applicable law, policy, and regulation.

A citizens' proposal for recommended wilderness should be treated as a proposed alternative submitted via scoping

There was a suggestion to analyze a citizens' proposal for recommended wilderness as an alternative of the revised draft plan EIS. This suggestion was considered, but not analyzed in detail because the recommended wilderness analyzed under alternative 5 includes over 745,000 acres that includes and exceeds the 432,166 acres recommended by the citizens' proposal. The boundaries of most areas recommended by the citizens' proposal are within very close alignment to those of alternative 5, with some adjustments made to accommodate alternative criteria identified of the analysis process.

Comparison of Plan-Level Alternatives

This section provides a summary comparison of the alternatives. Table 1 focuses on differences in management direction and anticipated outcomes that can be compared quantitatively or qualitatively. Some of the information used to compare alternatives is based on the forest plan decisions (e.g., objectives, suitability) and some of the information is based on expected outcomes of implementing each alternative (e.g., amount of forest products available). The plan components for resources or activities not within this table would be consistent across the alternatives.

Table 1. Primary differences between alternative management direction and anticipated outcomes

Bold italicized text is used to highlight the differences in wording in comparison to alternative 2.

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Restoration Methods/Tools to maintain or move toward desired conditions	Combination of naturally ignited wildfire, prescribed fire and mechanical thinning methods	Combination of naturally ignited wildfire, prescribed fire and mechanical thinning treatments	Emphasizes mechanical treatments or thinning treatments and limits the use of prescribed fire	Same as alternative 3	Emphasizes using naturally ignited wildfire and prescribed fire with some mechanical treatments or mechanical thinning treatments in the wildland-urban interface
Priority Vegetation Types for restoration	No Objectives for specific vegetation types forest-wide	Combination of grassland and open-canopy woodlands, and forest types	Grassland and open-canopy woodlands	Forest types	Combination of grassland and open-canopy woodlands, and forest types
Spruce-Fir Forest	No Objective	Objective[f] Treat at least 250 and no more than 23,779 acres per decade using a combination of naturally ignited wildfire and prescribed fire methods	No Objective	No Objective	No Objective
Mixed Conifer with Aspen	No Objective, but from 2007 to 2017 treated 167 acres using mechanical methods; and 1,539 acres using naturally ignited wildfire	Objective Treat at least 300 and no more than 73,934 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	No Objective	Objective *Treat at least 300 acres per decade* ***using mechanical methods and no more than 20 acres per decade using prescribed fire***	Same as alternative 3

[f] The pool of congressionally appropriated dollars for vegetation treatments between 2007 and 2017 was used to develop plan objectives under each alternative. These funds were re-allocated between treatment types based on cost estimates of doing the treatments, and the theme of the alternative. The exercise was intended to demonstrate that the plan is within the fiscal capacity of the forest, which is a requirement of the 2012 Planning Rule. If partnerships and associated funding make additional treatment possible, acres will change.

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Mixed Conifer-Frequent Fire	No Objective, but from 2007 to 2017 treated 515 acres using mechanical methods; 4,795 acres with prescribed fire and 29,515 acres using naturally ignited wildfire	Objective Treat at least 6,875 and no more than 282,400 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	No Objective	Objective ***Treat at least 12,500 acres per decade using mechanical methods and no more than 2,000 acres per decade using prescribed fire***	Objective ***Treat at least 5,500*** and no more than 282,400 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Ponderosa Pine Forest	No Objective, but from 2007 to 2017 treated 9,445 acres using mechanical methods; 50,508 acres with prescribed fire and 59,274 acres using naturally ignited wildfire	Objective Treat at least 6,320 and no more than 600,300 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	No Objective	Objective ***Treat at least 29,230 acres per decade using mechanical methods and no more than 12,600 acres per decade using prescribed fire***	Objective ***Treat at least 55,000*** and no more than 600,300 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Ponderosa Pine-Evergreen Oak	No Objective, but from 2007 to 2017 treated 4,093 acres using mechanical methods; 33,411 acres with prescribed fire; and treated 29,360 acres using naturally ignited wildfire	Objective Treat at least 1,000 and no more than 540,000 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	No Objective	Objective ***Treat at least 10,000 acres per decade using mechanical methods and no more than 2,000 acres per decade using prescribed fire***	Objective ***Treat at least 25,000*** and no more than 540,000 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
PJ Grass Woodland	No Objective, but from 2007 to 2017 treated 2,890 acres using mechanical methods; 3,795 acres with prescribed fire and; 10,623 acres per decade using naturally ignited wildfire	Objective Treat at least 4,000 and no more than 145,800 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	Objective ***Treat at least 19,000 acres per decade using mechanical methods and no more than 500 acres per decade using prescribed fire***	No Objective	Objective ***Treat at least 24,000*** and no more than 145,800 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Juniper Grass Woodland	No Objective, but from 2007 to 2017 treated 190 acres using mechanical methods; 30 acres with prescribed fire and; 0 acres using naturally ignited wildfire	Objective Treat at least 4,000 and no more than 88,000 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	Objective ***Treat at least 13,000 acres per decade using mechanical methods and no more than 500 acres per decade using prescribed fire***	No Objective	Objective ***Treat at least 18,000*** and no more than 88,000 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
PJ Woodland	No Objective, but from 2007 to 2017 treated 6,717 acres using mechanical methods; 34,182 acres with prescribed fire; and 34,321 acres using naturally ignited wildfire	No Objective	Same as alternative 2	Same as alternative 2	Same as alternative 2
Montane/ Subalpine Grasslands	No Objective, but from 2007 to 2017 treated 5,359 acres using mechanical methods; 5,220 acres with prescribed fire; and 11,334 acres using naturally ignited wildfire	Objective Treat at least 4,600 and no more than 94,800 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	Objective ***Treat at least 11,000 acres per decade using mechanical methods and no more than 500 acres per decade using prescribed fire***	No Objective	Objective ***Treat at least 12,000*** and no more than 94,800 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Colorado Plateau-Great Basin Grassland	No Objective, but from 2007 to 2017 treated 1,375 acres using mechanical methods; 470 acres with prescribed fire; and 1,259 acres per decade using naturally ignited wildfire	Objective Treat at least 2,000 and no more than 59,500 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	Objective ***Treat at least 8,800 acres per decade using mechanical methods and no more than 500 acres per decade using prescribed fire***	No Objective	Objective ***Treat at least 10,000*** and no more than 59,500 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Semi-Desert Grassland	No Objective, but from 2007 to 2017 treated 1,270 acres using mechanical methods; 25 acres with prescribed fire; and 883 acres per decade using naturally ignited wildfire	Objective Treat at least 800 and no more than 88,900 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	Objective ***Treat at least 6,000 acres per decade using mechanical methods and no more than 250 acres per decade using prescribed fire***	No Objective	Objective ***Treat at least 8,000*** and no more than 88,900 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Riparian Management (roads & infrastructure)	No plan direction	Guideline New construction or realignment of roads and motorized routes, recreation sites or other infrastructure should not be located within the 100-year floodplain, or within 300 feet of a Riparian Management Zone	Same as alternative 2	Same as alternative 2	Guideline New construction or realignment of roads and motorized routes, recreation sites or other infrastructure should not be located within the 100-year floodplain, or within ***500 feet of Riparian Management Zones containing perennial streams or native trout populations***
Wildlife, Fish and Plants	Guideline Road building in Protected Activity Centers should be avoided but may be permitted on a case-by-case basis for pressing management reasons.	No Guideline	Same as alternative 2	Same as alternative 2	Guideline ***New construction or realignment of roads and motorized routes, recreation sites or other infrastructure should not be located within a half-mile of known Mexican Spotted Owl Protected Activity Centers (PACs)***

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Livestock Grazing (plan direction)	No comparable standards or guidelines	Standard New or reconstructed range improvements will be designed to prevent wildlife entrapment (for example, escape ramps in water troughs and cattleguards) and allow for wildlife passage except where specifically intended to exclude wildlife (for example elk exclosure fence) and/or to protect human health and safety. Standard New livestock handling facilities designed to hold or concentrate livestock (for example corrals, traps, water developments) will be located outside of riparian management zone, known archeological sites and known occupied sites of at-risk species. Guideline Mineral (for example salt) or vitamin supplements should not occur on or adjacent to known occupied sites of at-risk plant species, known archaeological sites, or poorly drained or saturated, unsatisfactory soils, or those with severe erosion	***Guideline*** New or reconstructed range improvements ***should*** be designed to prevent wildlife entrapment (for example, escape ramps in water troughs and cattleguards) and allow for wildlife passage except where specifically intended to exclude wildlife (for example elk exclosure fence) and/or to protect human health and safety. ***Guideline*** New livestock handling facilities designed to hold or concentrate livestock (for example corrals, traps, water developments) ***should*** be located outside of riparian management zone, known archeological sites and known occupied sites of at-risk species.	Same as alternative 3	Standard New or reconstructed range improvements will be designed to prevent wildlife entrapment (for example, escape ramps in water troughs and cattleguards) and allow for wildlife passage except where specifically intended to exclude wildlife (for example elk exclosure fence) and/or to protect human health and safety. Standard New livestock handling facilities designed to hold or concentrate livestock (for example corrals, traps, water developments) will be located outside of riparian management zone, known archeological sites and known occupied sites of at-risk species.

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Livestock Grazing (plan direction) (continued)		hazard or high mass wasting hazard ratings. Guideline Restocking and management of grazing allotments following wildfire, mechanical vegetation treatment or other disturbance should be evaluated by an interdisciplinary team and the allotment permit holder to evaluate readiness. Livestock use of recovering riparian vegetation should be managed to maintain or improve canopy cover of native riparian and wetland species, including regeneration of woody riparian species.	***Guideline*** ***Mineral (for example salt) or vitamin supplements should not occur on or adjacent to known occupied sites of at-risk plant species, known archaeological sites, or poorly drained or saturated, unsatisfactory soils, or those with severe erosion hazard or high mass wasting hazard ratings.*** ***Guideline*** ***Restocking and management of grazing allotments following wildfire, mechanical vegetation treatment or other disturbance should be evaluated by an interdisciplinary team and the allotment permit holder to evaluate readiness. Livestock use of recovering riparian vegetation should be managed to maintain or improve canopy cover of native riparian and wetland species, including regeneration of woody riparian species.***		***Standard*** Mineral (for example salt) or vitamin supplements ***will*** not occur on or adjacent to known occupied sites of at-risk plant species, known archaeological sites, or poorly drained or saturated, unsatisfactory soils, or those with severe erosion hazard or high mass wasting hazard ratings. ***Standard*** Restocking and management of grazing allotments following wildfire, mechanical vegetation treatment or other disturbance ***will*** be evaluated by an interdisciplinary team and the allotment permit holder to evaluate readiness. Livestock use of recovering riparian vegetation ***will*** be managed to maintain or improve canopy cover of native riparian and wetland species, including regeneration of woody riparian species.

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Livestock Grazing (vacant allotments)	No comparable direction for vacant allotments	Guideline Vacant allotments should be considered for temporary use by holders of a current permit during times or events when their allotment(s) require growing season recovery time as a result of wildfire, drought or other disturbance, or to minimize livestock and wildlife conflicts. **Accompanying Restoration and Relationships management approach** describes intent to strategically select from these allotments a few that will remain vacant for use as forage reserves to increase options available to permittees.	Removes guideline; management approach is to stock vacant allotments to the maximum extent possible.	Same as alternative 3	Vacant allotments not used as a forage reserve Guideline 6 ***For allotments without current NEPA whose permits have been waived back to the government without a preferred applicant, the allotment should remain vacant and unstocked until site-specific NEPA is completed to evaluate condition (e.g., any restoration needs) and issues (e.g., any wildlife conflicts) and to determine future management and uses***. **Removes Restoration and Relationships management approach**

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Timber, Forest and Botanical Products	**No Guideline**	**No Guideline**	Same as alternative 2	Same as alternative 2	**Adds Guideline** ***Mechanical treatments should be restricted to the Urban Interface except in strategic locations identified through science-based analysis where such analysis indicates such treatment is necessary to restore landscape-scale adaptive capacity, or mitigate the potential for undesirable fire effects***
Land adjustments (for example, acquisitions, exchanges)	Does not **have guideline for no-net loss of private property** ***Goal for lands and special uses is to conduct landownership adjustment, right-of-way-acquisition, land line location, and special-uses programs to promote efficient management.***	Does not **have guideline for no-net loss of private property** **Management approach for land adjustments** intent is to enhance public access and use, and support resource management objectives and provides criteria for identifying desirable lands.	***Guideline*** Land exchanges should be preferred over acquisitions so that no net loss of private property in a county occurs. ***Management approach for land adjustments is removed.***	Same as alternative 3	Same as alternative 2

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
		Designated and	**Management Areas**		
Group Size Limit in Wilderness	Standard (for Designated Wilderness) Maximum group size will be limited to 25 persons and/or 35 head of pack and saddle stock.	Standard (for Designated and Recommended Wilderness) The default group size limit shall be 15 persons and 25 head of pack and saddle stock. Exceptions to group size limits may only be granted by written permission of the forest supervisor or designated agent, including when approved as terms and conditions of special-use permits on a case-by-case basis, groups that agree to mitigation terms and demonstrate a high proficiency for Leave No Trace Ethics, for fire management activities, and all emergencies involving health and safety.	Guideline ***Outfitter-guide operating plans should include appropriate wilderness practices, follow Leave No Trace principles, and incorporate awareness for wilderness values into their guide trainings and client interactions. If other management strategies are ineffective, group size limits may be established in the operating plan where needed to meet management goals. Outfitters who demonstrate an ability to preserve and respect the wilderness may have less restrictive group size limits.***	Same as alternative 3	Same as alternative 2

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Amount of Recommended Wilderness	0 acres No new areas recommended	110,402 acres Some new potential recommended wilderness taking into consideration other forest uses and restoration needs	130,012 acres Wilderness recommendations not made in areas identified as needing restoration in grassland and open woodland vegetation and providing access to traditional recreational, cultural, and historical uses of the forest	72,901 acres Wilderness recommendations not made in areas identified as needing restoration in forested vegetation or being suitable for timber production and providing access to traditional recreational, cultural, and historical uses of the forest	745,286 acres Wilderness recommendations are not made in wildland-urban interface areas and areas need to provide defensible space around adjacent and inholding private property
Wilderness Study Areas	Included in recommended wilderness acres above, not in addition to 27, 660 acres not recommended for designation	Included in recommended wilderness acres above, not in addition to Same as alternative 1	Included in recommended wilderness acres above, not in addition to Same as alternative 1	Included in recommended wilderness acres above, not in addition to 8,800 acres recommended for designation	Recommended for designation
Research Natural Areas (Proposals)	4 areas recommended 1,878 acres	2 areas recommended 1,500 acres	No new recommendations	Same as alternative 3	Same as alternative 2
Eligible Wild and Scenic Rivers (miles)	224.11	224.11	224.11	224.11	224.11
Wildland-Urban Interface	No Objective, but from 2007 to 2017 treated 5,660 acres using mechanical methods and 10,820 acres using prescribed fire methods	<u>Objective</u> Treat between 16,480 to 249,000 acres per decade using any combination of mechanical and prescribed fire methods	<u>Objective</u> *Treat **at least 4,500 acres*** per decade using mechanical methods ***and no more than 725 acres*** per decade using prescribed fire methods	<u>Objective</u> Same as alternative 3	<u>Objective</u> Treat between 16,480 to 249,000 acres per decade using any combination of mechanical and prescribed fire methods

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Botanical Areas	None	3 Areas 68,171 acres Managed as Management Areas	None	None	3 areas 150,590 acres Managed as Designated
Timber Suitability (suitable acres)	354,246	352,922	351,028	354,205	29,998
Sustained Yield Limit (MMBF[g] per decade/MMCF[h] per decade)	583/130	583/130	583/130	583/130	583/130
Projected Timber Sale Quantity MMCF/ decade average	9	9	1.5	28	3.5
Projected Wood Sale Quantity MMCF/ decade average	10.5	10.5	12	40.5	7.7
Saw Timber (MMBF)/ decade average	34	29.5	5	129	7.9
Livestock Animal Unit Months	226,041	250,611	243,240	248,154	255,525
Recreation Visits	445,054	454,784	448,946	445,054	450,892

[g] Million Board Feet
[h] Million Cubic Feet

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Annual Total Forest Management Jobs	1,099	1,131	1,120	1,146	1,135
Annual Labor Income ($1,000s of 2016$)	$33,715	$34,298	$33,977	$35,482	$34,256

Herbicide Use Alternative Development

Alternatives Considered in Detail

Alternative A, No Action

This alternative serves as a baseline for comparing the effects of alternatives. The no-action alternative would not authorize or initiate any new actions for treating noxious plants or the use of additional herbicides beyond what is currently covered under previously signed decisions. If the no action alternative were selected, limited herbicide use for invasive and noxious weeds would continue, based on the 2000 forest-level decision below. Under the no-action alternative, proposals and decisions to treat re-sprouting native species such as alligator juniper and evergreen oak would continue to be analyzed and authorized on a project-by-project basis.

In the Gila NF, noxious weed treatments have been implemented under two decisions approving the use of herbicides and mechanical treatments. One is for the entire forest (Environmental Assessment for Noxious Weed Management, U.S. Department of Agriculture (USDA) Forest Service, Gila NF 2000) and the other is for the Gila River and its tributaries (Gila River Saltcedar Treatment, USDA Forest Service, Wilderness Ranger District, Gila National Forest 2006). Collectively, these decisions authorize:

- Manual removal and chemical treatment of species on NMDA's noxious weed list as it existed in 2000, with the addition of tree of heaven (*Ailianthus altissima*) made in a 2015 supplement to the above-mentioned 2000 environmental assessment.
- Use of 14 herbicides with risk assessments in 2000.
- Application methods using backpack, all-terrain vehicle, or truck-mounted spraying equipment.

Currently, there are project-level proposals to treat native species such as alligator juniper and other re-sprouting woody species with herbicides. Two projects have decisions, one of which was implemented and completed during the 2018 fiscal year.

These decisions also include recommendations and requirements for implementing the Gila NF's integrated weed management program and minimizing risk to environmental quality and human health. Requirements include:

- Herbicides must be approved by the EPA, and by the states of New Mexico and Arizona for use in their respective state.
- Herbicide labels must be followed. Use must align with the specific purpose and target species included on the label.
- The herbicide must have a completed EPA and Forest Service risk assessment.
- A Pesticide Use Proposal and related safety plan must be completed and approved annually or prior to implementation.
- An annual program of work must be developed and include consultation with the USFWS to avoid potential effects on listed or proposed species.

Elements Common to the Action Alternatives

All action alternatives would provide authority and guidance for integrated, cost-effective noxious weed treatments in the Gila NF for the next 15 years or more, depending on the results over time. Manual removal and herbicide treatments would be approved for noxious weed species forest-wide. Noxious weed species qualifying for herbicide treatment would include all species listed on the most current APHIS, NMDA, or other state department of agriculture noxious weed lists. Any noxious plant species added to these lists after this decision would subsequently be available for treatment. The use of any herbicide for which there is both an EPA approved risk assessment and a Forest Service risk assessment would be permissible (see appendix K). All application methods would be authorized except aerial application methods, which are not included in the proposed action.

Activities authorized under all of the action alternatives would be subject to the following design criteria, which are also included as plan guidelines or standards in all of the draft plan alternatives.

Forest Plan Guidelines:

- When more than one herbicide may be suitable for a specific application scenario, the one with the lowest toxicity to wildlife should be selected unless there is information to suggest that doing so would promote the development of resistance to the lower toxicity herbicide in target species.

Forest Plan Standards:

- Integrated pest management will be used to prevent, control, contain, or eradicate noxious species to maintain or improve ecosystem and watershed function, while minimizing treatment impacts on native species and human health. Chemical and biological methods of pest control will only be used when physical or cultural methods are unlikely to be successful.
- Application of any and all herbicides will be performed or directly supervised by a state or federally licensed applicator.
- All treatment projects that involve the use of herbicides will develop and implement pesticide-use plans that include transportation and handling specifications.
- Herbicide use will be restricted to those formulations containing active ingredients that have both an EPA and Forest Service risk assessment. To reduce the risk of synergisms or enhanced effects as a result of using more than one herbicide, mixtures of herbicide formulations may only be applied where the sum of all individual Hazard Quotients for the relevant application scenario is less than 1.0.
- Use only non-toxic adjuvants, such as surfactants or dyes, and inert ingredients included in Forest Service hazard and risk assessment documents.
- All application methods—except aerial methods—will be acceptable as permitted by the product label. All label instructions will be followed.
- To minimize or eliminate direct or indirect negative effects to non-target plants, animals, and water quality, follow the label and consult the risk assessment. Use site-specific soil characteristics, surface drainage patterns, proximity to surface water and local water table depth to determine the appropriate herbicide formulation, application timing, and method, and if there is a need for buffers. Where herbicide is likely to be delivered to surface waters, only use herbicides registered for aquatic use.
- For herbicide formulations not registered for aquatic use, the minimum buffer distances will be as follows:

  - ♦ Class 0 herbicides, including aminocyclopyrachlor, aminopyralid, imazapic and imazapyr do not require a minimum buffer.
  - ♦ Class 1 herbicides require a minimum buffer of 30 feet from surface water or wetland edge. These herbicides include chlorsulfuron, clopyralid, glyphosate, isoxaben, metsulfuron methyl, picloram, sulfometuron methyl, tebuthiuron, acid formulations of fluroxypyr and non-aquatic amine salt formulations of triclopyr.
  - ♦ Class 2 herbicides require a minimum buffer of 50 feet from surface water edge and at least 10 feet from native riparian vegetation. These herbicides include dicamba, non-aquatic amine salt formulations of 2,4-D, and ester formulations of triclopyr.
  - ♦ Class 3 herbicides require a minimum buffer of 100 feet from surface water or wetland edge and at least 20 feet from native riparian vegetation. These herbicides include ester formulations of 2,4-D.
  - ♦ For pool habitats, apply at least a 30-foot buffer from water's edge when there is no surface flow in and out of pool.
- Loading or mixing of herbicides will occur at a minimum of 300 feet from live water and private residences.
- Backpack spray and boom or broadcast spray applications will use drift control agents to reduce the potential for drift to non-target species, food, and water sources.
- To reduce the risk of offsite and non-target impact, application will only occur under favorable weather conditions as identified in the label instructions and in accordance with equipment manufactures specifications. All spraying will occur with winds less than 10 miles per hour and greater than 3 miles per hour unless otherwise indicated in the label instructions.
- If there is a 50 percent or greater probability of local rain of 0.25 inch or more within 24 hours, then applications will only occur when it is anticipated that there will be sufficient time (at least 4 hours) for the application to dry before rainfall occurs.
- Granular herbicides will not be used on slopes greater than 15 percent due to the probability of runoff carrying the granules into non-target areas.
- Herbicides will only be used where they are deemed necessary to move toward desired conditions for vegetation communities and the urban interface. Where herbicide treatment is chosen, the rationale will be documented.
- Before implementing herbicide treatments, forest staff will ensure timely public notification. Treatment areas will be signed to inform the public and agency personnel of herbicide application dates and herbicides used. If requested, individuals will be notified in advance of spray dates.
- All treatment projects including herbicide use will be monitored for compliance with project design criteria and included in the biennial forest plan monitoring report.
- In designated and recommended wilderness areas, non-native, invasive species will be treated using methods and in a manner consistent with wilderness character to allow natural processes to predominate.
- Herbicide must not be sprayed within 100 feet of known rock art sites, caves, or rock shelters due to the possibility of perishable materials.

- All timing stipulations, terms and conditions, reasonable and prudent measures, buffers, or avoidance areas identified through consultation efforts (i.e., tribal, Section 106, and Section 7) and site-specific analysis will be integrated into application scenarios.
- All standards for the use of herbicide provided under the Non-native Invasive Species heading (included above) will be followed.

Alternative B, Proposed Action

The proposed action for herbicide use would add the authority and guidance for integrated, cost-effective noxious weed management, fuels reduction, and restoration treatments. This is intended to support movement toward, achievement, and maintenance of desired conditions for ecosystems, watersheds, and the wildland-urban interface. Manual removal and herbicide treatments would be approved for noxious weed species forest-wide. Mechanical treatments are not authorized, as the degree of ground disturbance caused by those treatments would likely provide the advantage to noxious and other disturbance adapted non-native plant species. Aerial application of herbicides would not be authorized for this proposed action. Both manual and herbicide treatments may need to be repeated to ensure that noxious and non-native invasive plant species are eradicated and controlled.

Noxious weed species qualifying for herbicide treatment would include all species listed on the most current APHIS, NMDA or other state department of agriculture noxious weed lists, and yellow bluestem (*Bothriochloa ischaemum*). Although yellow bluestem is not currently on any of the considered noxious weed lists, the regional forester recently requested NMDA to evaluate yellow bluestem (and Caucasian bluestem [*B. bladhii*]) for inclusion on the New Mexico State noxious weed list, and issued regional Forest Service guidance for its management, including recommendations for chemical treatment.

The proposed action would also authorize the use of herbicides on native, re-sprouting evergreen oak species and alligator juniper forest-wide. Wildland-urban interface areas are of particular concern with re-sprouting native woody vegetation. Treatments may need to be repeated if further re-sprouts are found after initial treatment. Herbicide use for restoration purposes would be tied to some kind of vegetation treatment, such as tree thinning, which would be a separate project-level NEPA analysis. While the herbicide use would already be NEPA authorized, should this alternative be selected, the NEPA analysis for a vegetation-thinning project would include disclosure of the specifics related to herbicide use; consultation with tribal governments, the USFWS, and the State Historic Preservation Office. There are also permitting and reporting requirements through the EPA to fulfill section 402 of the Clean Water Act.

Alternative C

This alternative was developed to respond to issues surrounding the use of herbicide to treat native species. It is identical to the proposed action in the way it addresses noxious weed treatments, but does not include any treatment of native species.

Alternative D

Alternative D was developed to respond to issues surrounding the use of herbicide to treat native species. It is identical to the proposed action and alternative C in the way it addresses noxious weed treatments. The proposed action and alternative D allow chemical treatment of native species; however, alternative D would restrict herbicide applications for native species to the urban interface.

Alternatives Considered but Eliminated from Detailed Study

Rely Solely on Non-Herbicide Treatments

Some stakeholder input indicated substantial concern over the use of herbicides and suggested the Gila NF not use any herbicides, even for noxious plants, in favor of other methods. This approach would not adequately meet the purpose and need for action to treat noxious plant species in a manner consistent with the direction for non-native invasive plant species found in any of the plan-level alternatives. The desired condition is for healthy, native plant communities where composition, structure, pattern, and processes are within what is known about the historic range of variation.

For some noxious plant populations, the size, density, or nature of the species may require the application of herbicides for effective treatment. For example, Canada thistle has an extensive lateral root system. Digging them up does not work because root fragments are left behind, from which new plants can sprout. Although such manual treatment can be successful in preventing seeding, it is unlikely to result in a reduction in the size and density of the infestation.

Use Herbicide Treatments on More Native Species

Some input reflected a desire for forest management to include the use of herbicide on several more native species on a forest-wide basis including, but not limited, to rabbitbrush, honey mesquite, broom snakeweed, and New Mexico locust. Expanding the use of herbicides to this extent would not meet the intent of using herbicide on an appropriate scale as necessary to meet objectives and promotes a dependence on chemicals to attain and maintain desired conditions. If there were a need to treat these or other native species at select locations on the forest in the future, a separate environmental analysis would be required.

Comparison of Herbicide Use Alternatives

This section provides a comparative summary of the herbicide-use alternatives in terms of how they address the purpose and need (project-level objectives) and the issues identified by the stakeholders (see table 2).

Table 2. Comparison of herbicide-use alternatives

Objective or Issue	Alternative A (No Action)	Alternative B (Proposed Action)	Alternative C	Alternative D
Objective: include updated risk assessments and new herbicides for noxious weed treatment	Does not update current analysis and decision	Updates current analysis and decision to include updated risk assessments and new herbicides	Same as alternative B	Same as alternative B
Objective: prepare for rapid response to emerging threats posed by noxious weeds	Does not provide for rapid response to emerging weed-related threats	Highest ability to respond rapidly to emerging weed-related threats by incorporating noxious weed lists by reference and authorizing the use of additional herbicides	Same as alternative B	Same as alternative B
Objective: move toward plan-level desired conditions for *native* vegetation communities	Provides for herbicide use to maintain or move toward desired conditions for *some* situations	Provides for herbicide use to maintain or move toward desired conditions for *most* situations	Same as alternative B	Same as alternative B
Objective: move toward plan-level desired conditions for vegetation community composition, structure, pattern and process	Does not provide for herbicide use as one of several tools to move toward desired conditions	Adds herbicide use as one of several tools to move toward desired conditions	Same as alternative A	Same as alternative A
Objective: move toward desired conditions for the Wildland Urban Interface	Does not provide for herbicide use as one of several tools to move toward desired conditions	Adds herbicide use as one of several tools to move toward desired conditions	Same as alternative A	Same as alternative B
Issue: herbicides and human health	Some risk associated with herbicide use - protection provided by label law and risk assessments	Some risk associated with herbicide use – protection provided by label law, risk assessments, hazard quotients less than one and notification and accountability measures	Same as alternative B	Same as alternative B
Issue: herbicides, wildlife and fish	Some risk associated with herbicide use - protection provided by label law and risk assessments	Some risk associated with herbicide use – protection provided by label law, risk assessments, hazard quotients less than one and other design criteria	Same as alternative B	Same as alternative B
Issue: herbicides and targeting native plant species	Does not authorize herbicide on native plant species	Authorizes herbicide use on native alligator juniper and evergreen oak forest-wide to move toward desired conditions for vegetation communities and the urban interface	Same as alternative A.	Authorizes herbicide use on native alligator juniper and evergreen oak but restrict such activities to the urban interface
Issue: herbicides and non-target effects to native plant species	Adverse effects are possible – minimized by label law	Adverse effects are possible – minimized by label law and design criteria	Same as alternative B.	Same as alternative B.

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Chapter 3. Affected Environment and Environmental Consequences

Introduction

This chapter summarizes the affected ecological (physical and biological), cultural, social and economic environments, existing conditions and the potential environmental consequences of implementing each plan alternative on those environments. It also presents the scientific and analytical basis for the comparison of the alternatives presented in chapter 2. The NEPA requires analyses to address direct, indirect, and cumulative effects of a proposed action and its alternatives. More detailed information, including methodology, assumptions, and effects analysis are available in appendices B through J and in the administrative records of the plan revision process and the NEPA review.

Environmental Consequences

Forest plans provide a programmatic framework that guides site-specific actions, but do not mandate, authorize, fund, or carry out any project or activity. Because the forest plan does not authorize or mandate any site-specific projects or activities (including ground-disturbing actions), there can be no direct effects from the plan itself. On the other hand, plans may have long-term environmental implications or consequences, so there can be indirect effects. Those environmental consequences are described in this chapter. Project-level proposals do authorize activities and have both direct and indirect effects.

Cumulative Effects

"Cumulative effects" are defined in the White House Council of Environmental Quality's NEPA regulations as the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions..." (40 CFR 1508.7). The council interprets this regulation as referring only to the cumulative impact of the direct and indirect effects of the proposed action and its alternatives when added to the aggregate effects of past, present, and reasonably foreseeable future actions across an area that is deemed appropriate for the impacts being analyzed. At the project level, this can include actions taken on lands of multiple jurisdictions if it is relevant to the area deemed appropriate for the impacts being analyzed. Cumulative effects for forest plans are slightly different than for project-level analyses. They always take a multi-jurisdictional look at actions and their associated effects, but the focus is on reasonably foreseeable future actions likely to occur during implementation that could have effects on neighboring lands, as well as actions likely to occur under the plans of other jurisdictions that could affect the forest.

This analysis follows the "Guidance on the Consideration of Past Actions in Cumulative Effects Analysis" issues by the council's chairman on June 24, 2005. The guidance states the expectation that agencies determine what information regarding past actions is useful and relevant to the required analysis of cumulative effects and further notes that the council's regulations do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Indeed, the analyses that follow do not attempt to quantify the effects of past human actions by adding up all prior planning actions on an action-by-action basis. Instead, the current environmental conditions serve as a proxy for the impacts of past actions. This is because the existing conditions reflect the aggregate impact of all prior human actions and natural events that are sometimes difficult to quantify but have affected the environment and might contribute to cumulative effects.

Plan-Level Assumptions Common to All Resources

The following assumptions were common to all resources in the plan-level analyses. They are not relevant to the herbicide-use analyses also presented in this chapter:

- No direct environmental effects will result from the administrative action of developing or revising the forest plan. Proposed actions will not be approved or otherwise authorized based on the content of the forest plan; however, they must be consistent with plan components, which include desired conditions, objectives, standards, guidelines, designation of management areas, suitability determinations, and monitoring requirements.
- Components of the forest plan reflect current Federal, State, and local laws and regulations, and USDA and Forest Service policy.
- Effects analyses are applicable for the expected life of the forest plan, which is estimated to be 10 to 15 years, unless otherwise noted in chapter 3.
- Monitoring during the life of the plan will be used to measure the continued applicability of plan components and the need for future amendments.

For additional resource-specific assumptions, please see the individual resource of interest within this document.

Herbicide Use Assumptions Common to All Resources

Herbicide-Use Assumptions Common to All Resources

The following assumptions were common to all resources in the herbicide-use analyses. They are not relevant to the plan-level analyses also presented in this chapter:

All law, regulation, policy, label instructions, plan direction and project design criteria are followed.

Upland Vegetation, Fire Ecology and Fuels

Affected Environment

All of the alternatives use the Ecological Response Unit (ERU) classification system (Wahlberg et al. 2014). The Forest Service Southwestern Region developed this system and uses it to facilitate landscape-scale analysis and planning. The ERU framework represents all major vegetation types in the region and a stratification of biophysical themes, similar to LANDFIRE biophysical settings. ERUs are map unit constructs that combine themes of site potential, historic disturbance regimes, and natural succession. Site potential is a term used to describe the characteristic ecological conditions at late development, resulting from interactions among climate, soil, and vegetation. The draft revised plan and the assessment report[i] both contain more information about this classification system.

The Gila NF contains 13 different upland ERUs[j] that make up approximately 98 percent of the forest. These include five distinctly different forest or timberland types, four woodlands, one shrubland, and three grassland types. These ERUs and the relative proportion of the upland vegetation they represent are displayed in figure 2. Riparian vegetation communities are discussed separately.

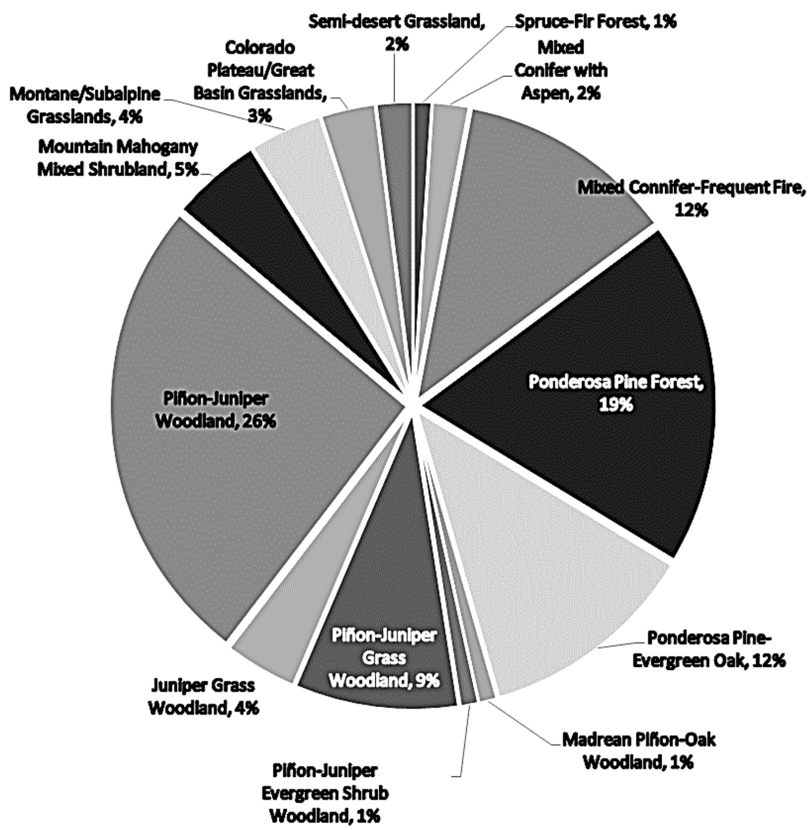


Figure 2. Percentage of upland vegetation in the Gila NF in each upland ERU

[i] https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd544951.pdf#page=34

[j] The area in PJ-Evergreen Shrub has been reclassified and is now part of the PJ Woodland ERU.

The forest is a frequent-fire landscape, but fire does not play the same role in every ERU. Roughly 56 percent of the forest's upland ERUs are characterized by frequent (0 to 35 years), low-severity fire regimes. These are the vegetation types that the terms "fire-adapted" and "fire-dependent" were originally coined to describe. However, this language is misunderstood and often misused, leading to over-generalization and misconceptions. It is not used in this document because fire plays a variable, and important role in every forest ecosystem.

The variability in fire regime characteristics are specific to location and are synchronized with climatic fluctuations (Weins et al. 2012). Examples from a pre-suppression era fire history study conducted in the Gila Wilderness (Abolt 1997) provide an illustration in table 3.

Table 3. Historical fire regime characteristics at select locations in the Gila Wilderness (1706–1904)

Location	Vegetation Type*	Average Number of Years Between Fires	Shortest Fire-Free Period (years)	Longest Fire-Free Period (years)
Snow Park	Mixed Conifer	12	3	41
Upper Langstroth Canyon	Mixed Conifer	8	3	14
Middle Langstroth Canyon	Mixed Conifer	15	9	31
Upper Cub Mesa	Mixed Conifer	7	2	36
Lower Cub Mesa	Ponderosa Pine	6	2	36
Langstroth Mesa	Ponderosa Pine	6	1	26

*As characterized by Abolt 1997, not the ERU classification.

Unfortunately, such reconstructions are not available for most areas in the forest. However, a general sense of natural role of fire in a particular ecosystem can be gained from aggregating all of the available information. Table 4 provides such a summary. Where data are insufficient, or the frequency and severity combination has not been documented, the abbreviation "U" is used in the table. While average values are presented here, the full range of historic variability and its randomness, plays an important ecological role (Agee 1993).

Table 4. Historic (“natural”) fire regime characteristics for Gila NF vegetation types

Ecological Response Unit	*Average Range of Years Between Fires (Mean Fire Return Interval) by Severity Class			** Average Fire Rotation
	Low	Mixed	High	
Spruce-Fir Forest	U	100-200	200-400	156
Mixed Conifer with Aspen	U	150-400		120
Mixed Conifer-Frequent Fire	0-35	35-200 or more[+]	U	22
Ponderosa Pine Forest	0-35	U	U	11
Ponderosa Pine-Evergreen Oak	2-200 or more[+]		U	13
Madrean Piñon-Oak Woodland[!]		35-200 or more[+]		U
PJ Evergreen Shrub	U	35-200 or more[+]	U	206
PJ Woodland		35-200 or more		255
PJ Grass Woodland	0-35	U	U	20
Juniper Grass Woodland	0-35	U	U	13
Mountain Mahogany Mixed Shrubland			35-200 or more[+]	U
Montane/Subalpine Grasslands	2-22	U	U	12
Colorado Plateau/Great Basin Grassland	0-35	U	U	15
Semi-desert Grassland	3-10	U	U	6

* The average or mean fire return interval is a point frequency estimate describing how often, on average, one would expect fire to occur at the same location on the ground (from Agee 1993).

** The average or mean fire rotation is an area frequency estimate describing how often, on average, one would expect it to take for an area the same size as the study area to experience fire. This does not mean that we would expect every point in the area to experience fire. Some areas could burn more than once and others not at all. It may be most useful when thought of as a rate of burning. This metric is somewhat limited in its practical utility as regional summaries have not included a definition of the “study area” size. From Agee 1993 and Krausmann and Triepke 2015.

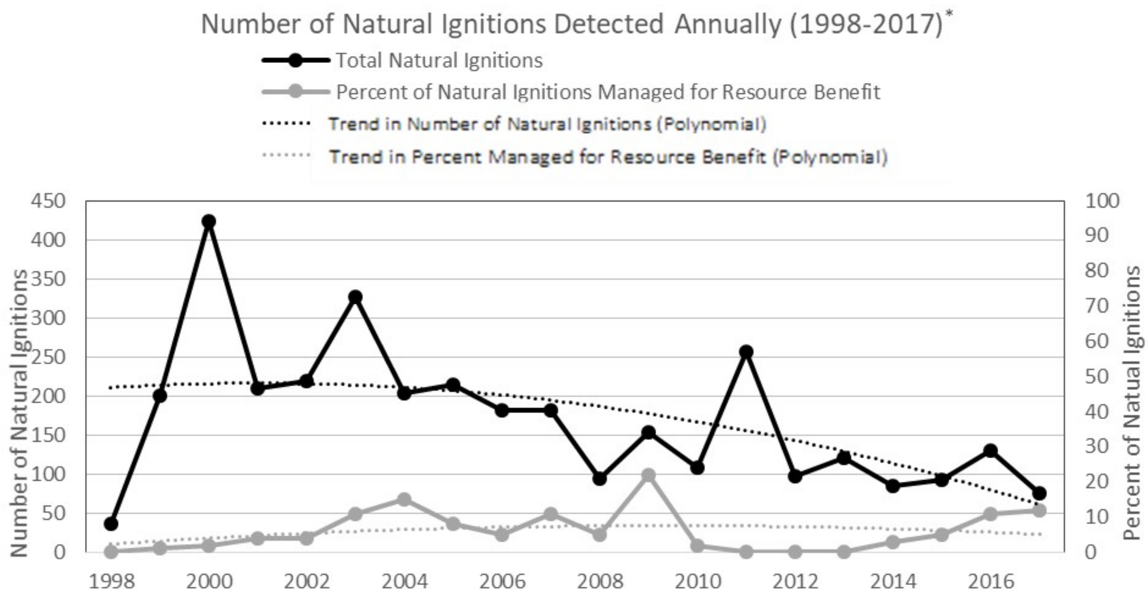
†U means the severity and frequency combination has not been documented or is supported by insufficient information.

! This information differs from the Madrean-Piñon Oak Woodland elsewhere in the Region due to differences between the physical site characteristics where it occurs in the Gila NF as compared to elsewhere. For more information please see the corresponding ERU description in the draft revised forest plan.

The historic role of fire changed in the late 1800s, with the arrival of Europeans and the decline in Native American populations. Changes in land management began to alter fire regimes in complex ways. Livestock grazing practices reduced herbaceous vegetation (fine fuels) and contributed to an increase in woody vegetation, because of reduced competition for water and nutrients (Rummel 1951; Madany and West 1983; Savage and Swetnam 1990; Dahms and Geils 1997; Boucher and Moody 1998; Smith 2006; among others). At the turn of the 19th century, the policy of fire suppression further contributed to an increase in woody vegetation and fuel loading. With substantially reduced understory and no fire, conifer seedlings survived at unprecedented rates, invaded openings and encroached into grasslands and previously open-canopy woodlands. Many large, old trees were harvested for lumber and fuelwood, also reducing structural diversity.

Over time, livestock and timber management practices improved, and while the Forest Service still actively suppresses some fires, the policy of total fire suppression ended. In the mid to late 1970s, the Gila became one of the first national forests to begin restoring fire to the landscape (Boucher and Moody 1998). Progress has been made, however, the road to fully restoring the resilience and adaptive capacity of the forest remains a long one.

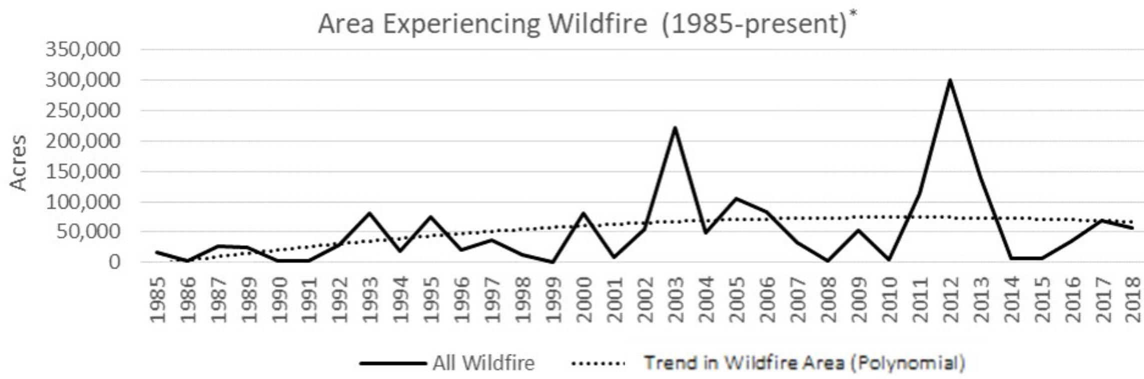
While there is science that suggests fire sizes were much larger prior to European settlement, many in the science community and the news media continue to highlight the contemporary trend in fire size (Westerling et al. 2006; among others) and severity (Dillon et al. 2011); and many predict the likelihood and occurrence of large, stand-replacing fires will continue to increase over the near term with current and future climatic trends. Yet, these trends are not yet playing out in the Gila NF. The forest has actually seen a decline in the number of natural ignitions detected annually (figure 3) and the percentage of these fires occurring under conditions that support management for resource benefit has remained relatively stable (figure 5).



*Information summarized from Silver City Interagency Dispatch Center annual fire logs. Period of record is determined by the available data. Prior to 1998, recordkeeping practices were not as good.

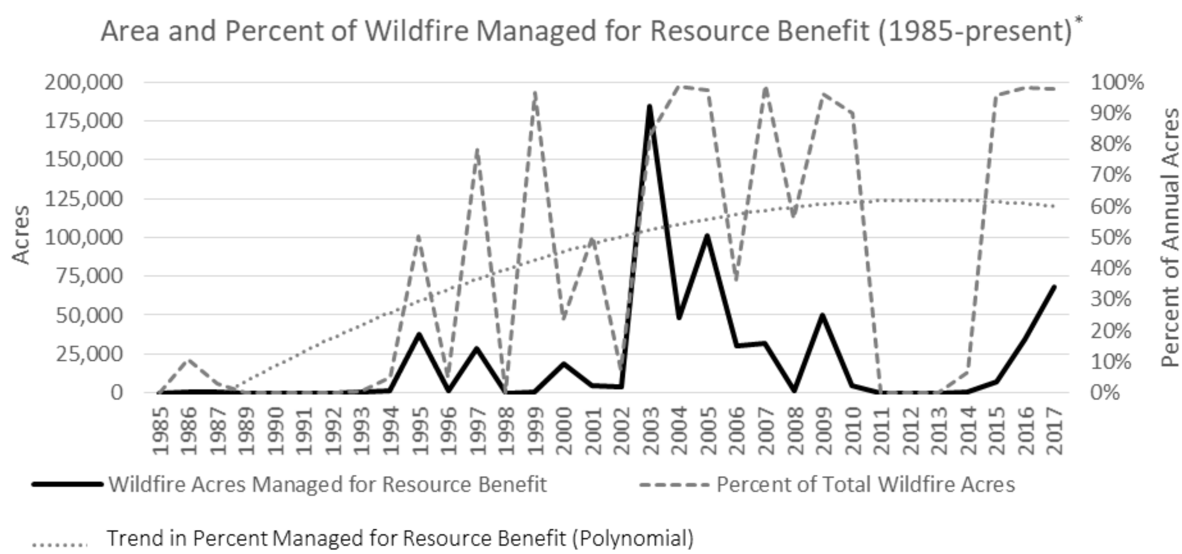
Figure 3. Trends in number of natural ignitions and percent managed for resource benefit

With regard to area experiencing wildfire each year there is no pronounced trend, although there was a slight increase between the end of the fire suppression era and 2003 (figure 4), as would be expected. Despite the relatively stable percentage of these fires being managed for resource benefit, there has been a slight upward trend in the area treated (figure 5). This reflects both the Gila NF's increasing emphasis on restoring natural fire regimes and the evolution of the way fire is managed on the landscape. To better protect wildland firefighters, fewer risks are being taken. Drawing larger fire perimeters to work within puts more distance between firefighters and the risk, leading to more acres burned.



*Information from Gila NF Fire History database. Period of record was chosen for consistency with the Monitoring Trends in Burn Severity (MTBS) dataset's period of record. Although the Gila NF's Fire History data has information for a longer time period, records are not as reliable prior to 1985.

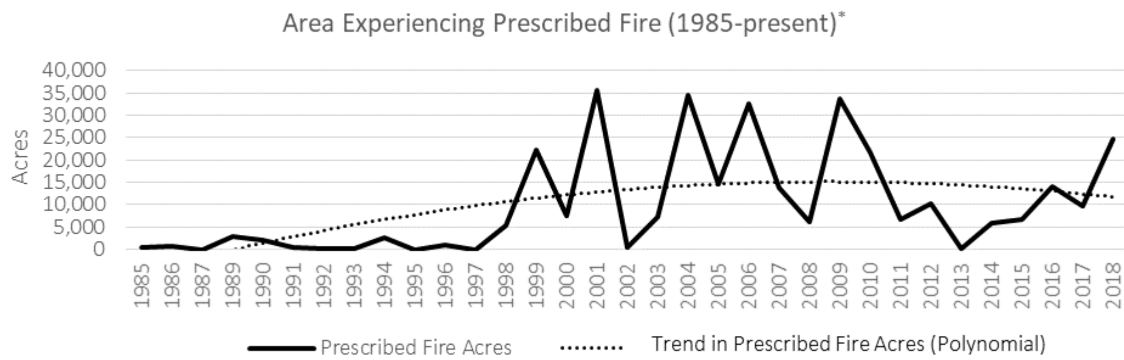
Figure 4. Trends in total Gila NF area experiencing wildfire



*Information from Gila NF Fire History database. Period of record was chosen for consistency with the MTBS dataset's period of record. Although the Gila NF's Fire History data has information for a longer time period, records are not as reliable prior to 1985.

Figure 5. Trends in area treated with wildfire

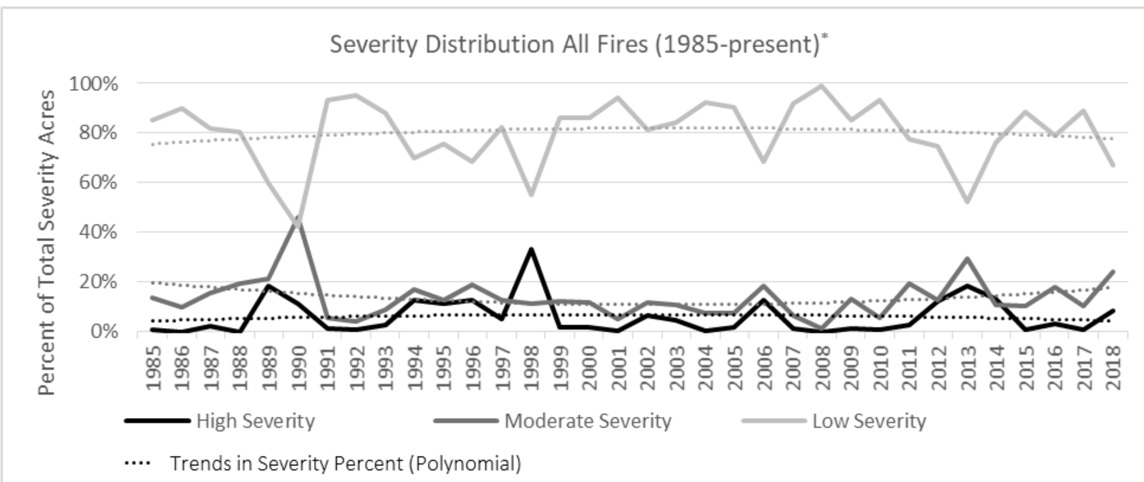
The area treated with prescribed fire demonstrates a similar pattern, albeit less pronounced (figure 6).



*Information from Gila NF Fire History database. Period of record was chosen for consistency with the MTBS dataset's period of record. Although the Gila NF's Fire History data has information for a longer time period, records are not as reliable prior to 1985.

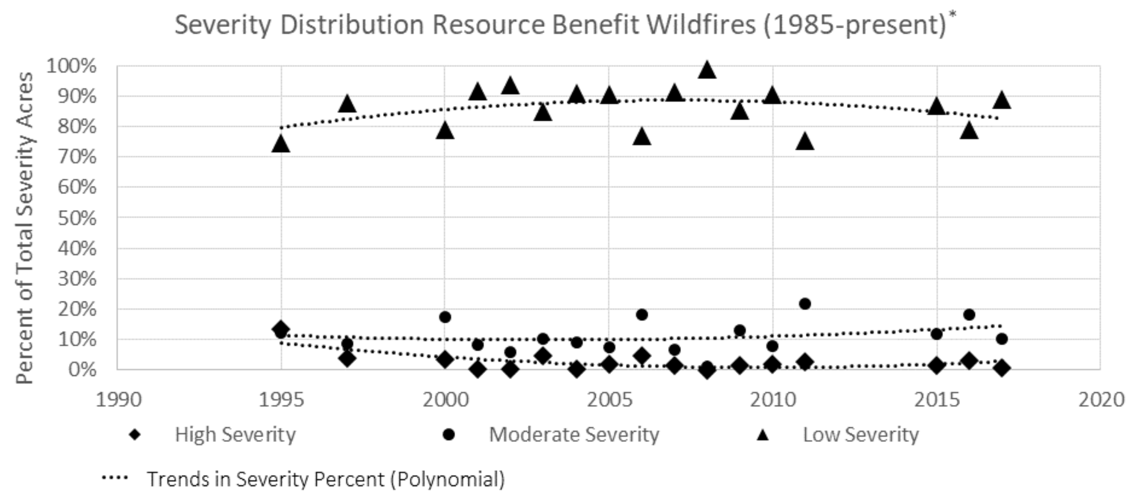
Figure 6. Trends in area treated with prescribed fire

There has been a very slight increase in the wildfire severity and a similar decrease in prescribed fire severity; however, there are no substantial trends (figure 7, figure 8, and figure 9). Severity trends summarized by ERU also provide little evidence that severities are changing, with predominantly low departure ratings (USDA FS Gila NF 2017). All the ERUs in high departure for fire severity are the result of lack of fire rather than an actual departure in observed severity.



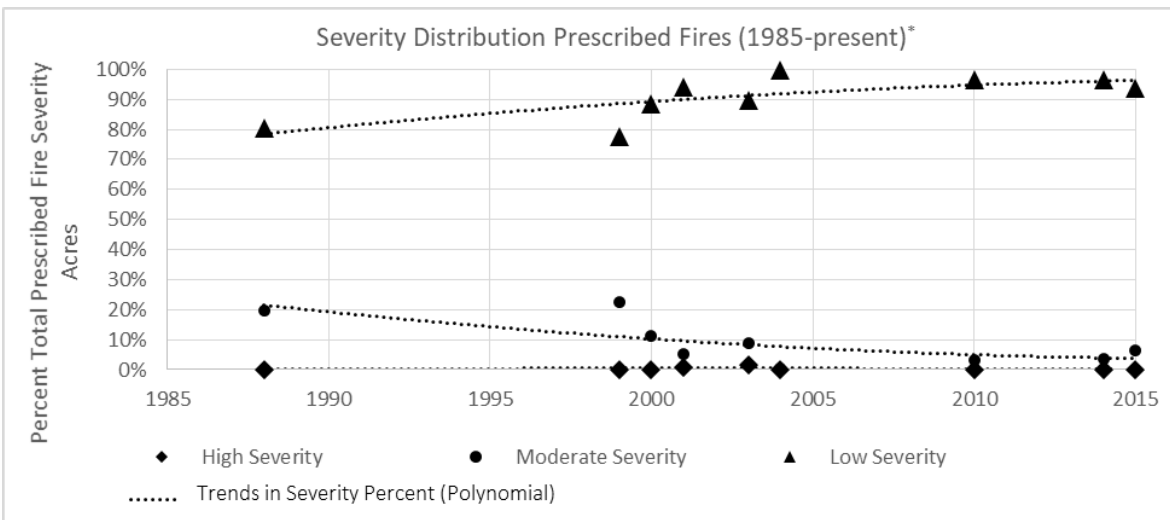
*Information from full period of record of the (MTBS dataset. MTBS data are only available on individual fires greater than 1,000 acres in size. MTBS data were not available for all 2018 fires when this analysis was generated.

Figure 7. Overall trend in fire severity



*Information from full period of record of the MTBS dataset. MTBS data are only available on individual fires greater than 1,000 acres in size. MTBS data were not available for all 2018 fires when this analysis was generated.

Figure 8. Trends in resource benefit wildfire severity



*Information from full period of record of the MTBS dataset. MTBS data are only available on individual fires greater than 1,000 acres in size. Relatively few prescribed fires have been greater than 1,000 acres. MTBS data were not available for all 2018 fires when this analysis was generated.

Figure 9. Trends in prescribed fire severity

While it is possible to conclude that the way the Gila NF has managed fire on the landscape is the reason for the decline in natural ignitions and lack of apparent trend in fire size and severity, this conclusion may be premature. Lightning strike, weather and fuel related variables have not been sufficiently explored, and most of the ERUs in the forest have a moderate to very high risk associated with altered composition, structure, pattern, and process (USDA FS Gila NF 2017).

Large extents of stand-replacement type fire remain a threat as illustrated by Parks and others (2018b), who have recently published spatial predictions of high-severity fire for areas currently under tree cover in the western United States. The following figures are taken from their work and display the current probability of high-severity fire in the Gila NF—*if* a fire were to occur. Figure 10 displays the predictions under average fire season weather conditions. Figure 11 displays the predictions under extreme conditions (95th percentile). This work does not include predictions for non-treed areas, regardless of how it is mapped in the ERU classification system, which means it is not valid in areas that were previously treed, but are currently in grass or shrub states because of stand-replacement fire. It is only valid in grasslands where woody encroachment is present. It is also based entirely on standing fuels as a comparable dataset for surface fuels is not currently available (Parks et al. 2018a). Figure 10 and figure 11 are followed by a tabular display of the predictions by ERU (table 5). Note that the imagery used to update the predictions from the date of the original publication pre-dated the 2018 Owl Fire near Luna, New Mexico. Severity patterns observed on that fire closely mirror what was predicted.

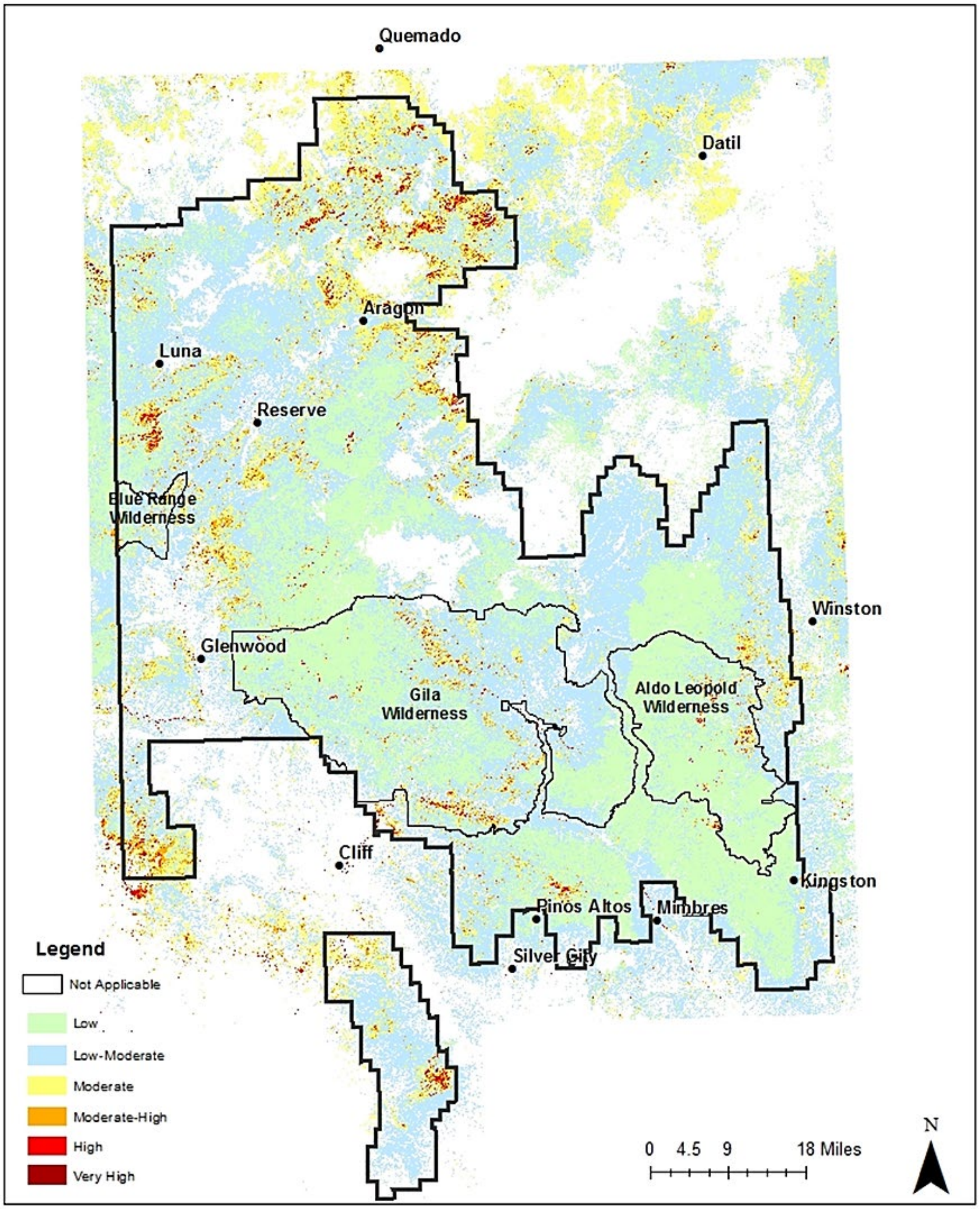


Figure 10. Predicted probability of stand-replacement fire (2018), if a fire occurs under average fire season weather

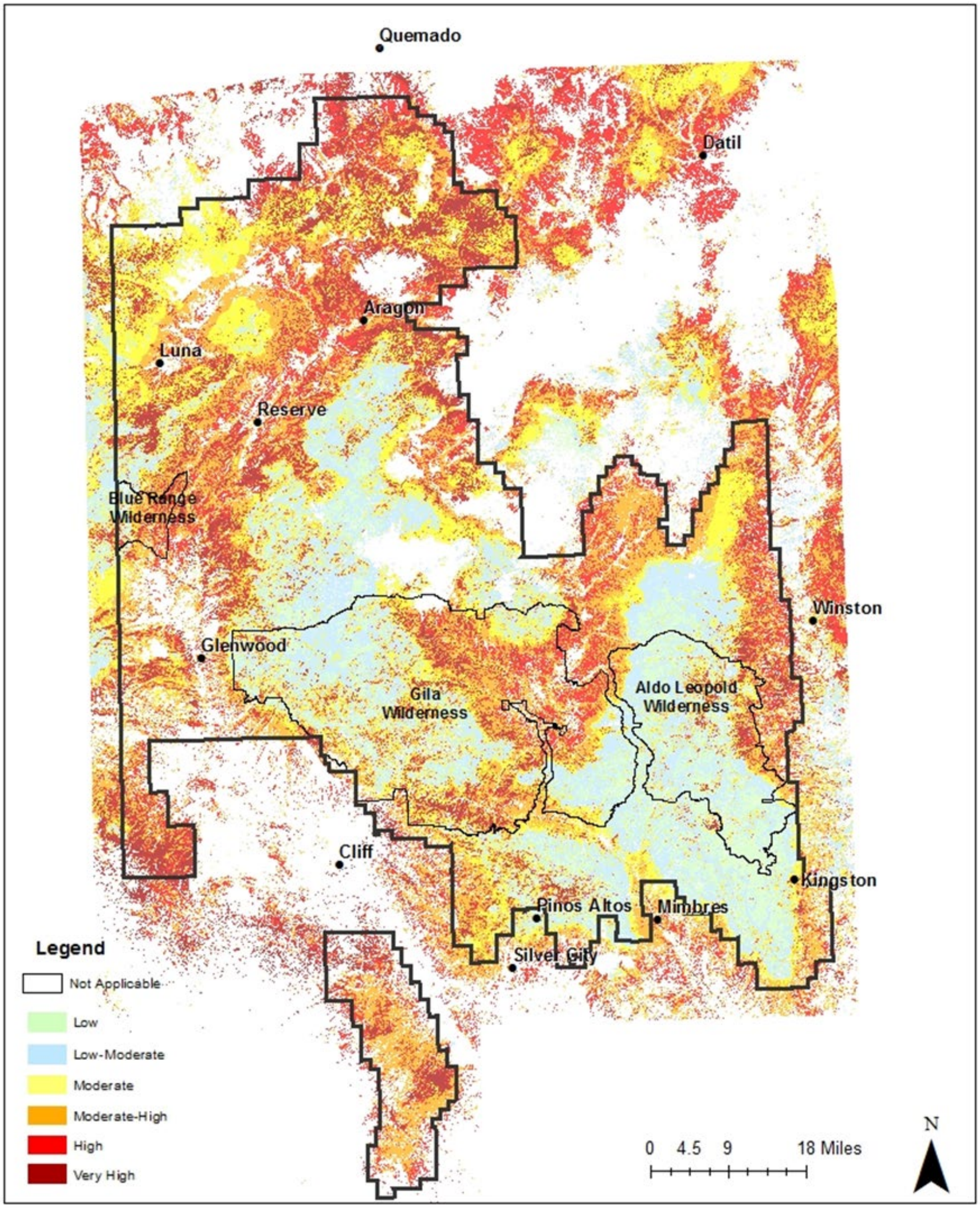


Figure 11. Predicted probability of stand-replacement fire (2018), if a fire occurs under extreme fire season weather

Table 5. Ecological response unit area with moderate or greater probabilities of high-severity fire under average and extreme fire season weather

ERU Name	Area with Predicted Moderate or Greater Probability of High-Severity Fire (percent of ERU)	
	Average Fire Season Weather	Extreme Fire Season Weather
Spruce-Fir Forest	3	16
Mixed Conifer with Aspen	6	25
Mixed Conifer-Frequent Fire	20	52
Ponderosa Pine Forest	19	66
Ponderosa Pine-Evergreen Oak	13	61
Madrean Piñon-Oak Woodland	23	79
PJ-Evergreen Shrub	28	77
PJ Woodland	14	70
PJ Grass Woodland	25	75
Juniper Grass Woodland	13	58
Mountain Mahogany Mixed Shrubland	7	55
Montane/ Subalpine Grassland	3	28
Colorado Plateau-Great Basin Grassland	5	40
Semi-Desert Grassland	2	35

Parks and others found that the strongest drivers of high-severity fire in the Arizona-New Mexico mountains are live fuel (approximately 75 percent) and fire weather[k] (approximately 15 percent). Climate and topography[l] are also drivers, explaining 9.7 and 0.2 percent (Parks et al. 2018b). This appears contradictory, given that many fire science studies have found topography to be a substantial driver. However, as Parks and others discuss, this is because topography has been looked at as a proxy for live fuels in the past, rather than as two separate variables. Regardless, these predictions suggest during average fire weather, live fuel densities in the Gila NF do not pose a widespread fire management challenge. Under extreme conditions, the management picture is a much different story.

While it might be expected that the infrequent, high-severity fire ecosystems in the forest would have a larger percentage of their area at moderate or greater risk, this is not consistently observed. Spruce-Fir Forest and Mixed Conifer with Aspen are less likely to experience stand-replacement fire than other ERUs, under both the average and extreme predictions. This is because much of the area they occupy has recently experienced stand-replacement fire. As time since the fire increases, these probabilities will likely increase.

Fire-facilitated type conversions concern many Gila NF staff and stakeholders, particularly in light of current and future predicted climatic trends. While it does not predict the mechanism of a type conversion, the Climate Change Vulnerability Assessment (Triepke 2015) provides both spatial (figure 12) and tabular summary (table 6) of the relative likelihood of type conversion in the Gila NF and the surrounding landscape. The spatial data have not been released to the forest, pending final

[k] The most influential fire weather variables include daily burning index, maximum daily temperature, annual heat moisture and annual climatic moisture deficit.

[l] The most influential climate variables are the average climatic moisture deficit and evapotranspiration (1981-2010). The most influential topographic variable is the topographic position index, which is a relative measure of valley bottom versus ridge top.

publication of this work. The map provided below (figure 12) was produced as part of the work done by the regional ecologist for the assessment report, and includes display of the "local units" that were used in the assessment to analyze spatial patterns (USDA FS Gila NF 2017).

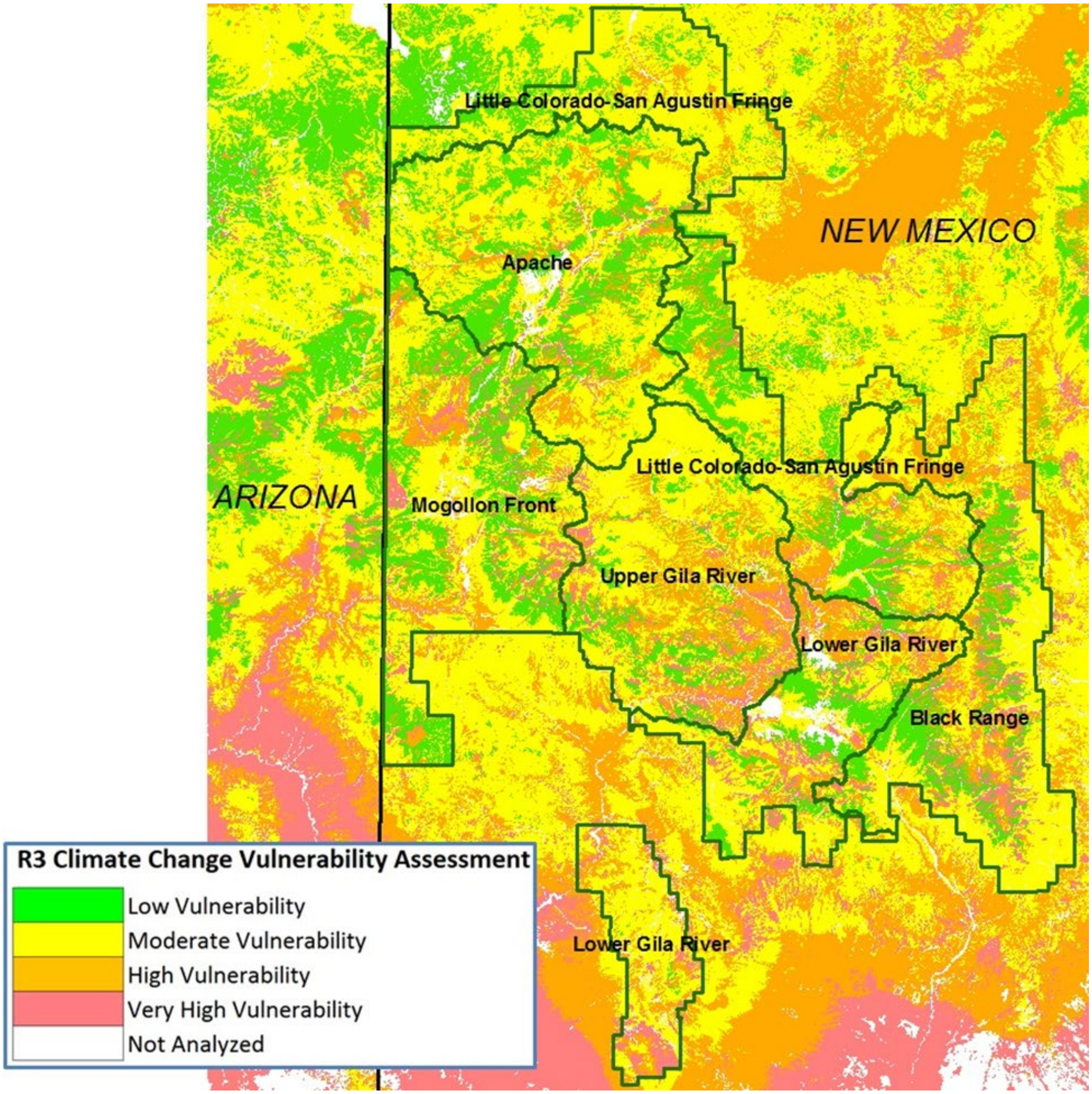


Figure 12. Spatial patterns of vegetation vulnerability to climate change

This work also provides quantitative evaluation of uncertainty based on how many of the climate models agreed. Table 6 summarizes both vulnerability and uncertainty at the forest scale. Ranges indicate there is greater variability depending on where in the forest a particular ERU is located.

Table 6. Vulnerability and uncertainty ratings for Gila NF ecological response units

ERU Name	Vulnerability	Uncertainty
Spruce-Fir Forest	Very High	Low
Mixed Conifer with Aspen	Moderate to Very High	Low to Moderate
Mixed Conifer-Frequent Fire	Moderate to High	Moderate
Ponderosa Pine Forest	Moderate to High	Moderate
Ponderosa Pine-Evergreen Oak	Moderate	Moderate
Madrean Piñon-Oak Woodland	Low to Moderate	Moderate
PJ-Evergreen Shrub	Not Analyzed	Not Analyzed
PJ Woodland	Low to Moderate	Moderate
PJ Grass Woodland	Low to Moderate	Moderate
Juniper Grass Woodland	Moderate to High	Moderate
Mountain Mahogany Mixed Shrubland	Low to Moderate	Moderate
Montane/ Subalpine Grassland	Moderate	Moderate to High
Colorado Plateau-Great Basin Grassland	Moderate	Moderate
Semi-Desert Grassland	Low to Moderate	Moderate

While climate change impacts to the forest's ecosystems may ultimately be beyond the control of management, actions taken within the life of the next forest plan could influence their trajectory. In turn, this will influence the types and amounts of benefits these ecosystems provide to people that the Gila NF is able to sustain in the future.

Wildland-Urban Interface

The wildland-urban interface (WUI) is the area or zone where structures and other human development meet and intermingle with undeveloped wildland or vegetative fuels. Generally, the WUI is a buffer around communities, private lands, or other infrastructure. The buffer size may vary based on topography, fuels, and values at risk. Although WUI areas are physically delineated places, it may be helpful to think of WUI not as a place, but rather as a set of conditions that can exist in and around nearly every community and surrounding many other types of infrastructure. These conditions are defined by the amount, type, and distribution of vegetation; the flammability of the structures (homes, businesses, outbuilding, decks, fences) in the area and their proximity to fire prone vegetation and other combustible structures; weather patterns and general climatic conditions, topography, hydrology, road construction and more.

Approximately 32 percent of housing units and one-tenth of all land with housing in the United States are in the WUI, and population growth is expected to continue the expansion of WUI. While the degree of risk may vary from one place to another, given the right conditions, wildfire can affect people and their homes in almost any location. Even structures not immediately adjacent to wildlands are at risk of damage from fire because embers can be transported by wind and ignite vulnerable homes a mile or more ahead of the flame front. As more people live or work in the WUI, fire management becomes more complex and the costs to reduce fire risk, manage wildfires and protect human life and property go up. Six percent of homes found in Catron, Grant, and Sierra counties are located in the WUI (USDA FS Gila NF 2017).

In recent years, the Gila NF has planned and implemented many projects that specifically decrease the potential for undesirable fire effects in these areas. While fire plays an important and variable role in all of the forest's ecosystems, even ecologically characteristic fuel conditions and fire behavior may not be desirable in WUI settings. Based on the work of Parks and others previously displayed and discussed, approximately 20 percent of the WUI currently has a moderate or greater probability of high-severity fire under average fire weather conditions. However, under extreme fire weather conditions, this percentage increases to approximately 71 percent. As climate change progresses, so likely will the fire-related risk to WUI values.

Plan-Level Environmental Consequences

The following discussion of environmental consequences addresses the effects of the alternatives on upland vegetation communities, fire ecology and fuels, both within and outside the WUI. It does not discuss the effects of vegetation, wildland fire, or fuels management on other natural resources or resource uses. Those discussions are housed under their respective topic headings.

Analysis Methodology

State-and-Transition Modeling

This analysis relies heavily on state-and-transition modeling to project vegetation changes over time under each plan alternative. States, or seral states, are point in time characterizations of vegetation community development from un-vegetated post-disturbance to the final, potential vegetation community adapted to the particular site conditions such as a grassland dominated by a diversity of perennial grass species, or a mature, old-growth forest. Transitions are the pathways of change between states, and can include human activities, fire, insects and disease pathogens, weather, growth, competition, and herbivory. This type of modeling has a long history of use by the Forest Service, Natural Resource Conservation Service and many others outside the USDA for comparing differences between broad, landscape-level management scenarios.

The state-and-transition models used in this analysis were developed specifically for the Forest Service Southwestern Region. They began as LANDFIRE models, which were subsequently refined by The Nature Conservancy, the Integrated Landscape Assessment Project, and the Forest Service Southwestern Regional Office based on published scientific literature, regional datasets, Forest Inventory and Analysis (FIA) data, Forest Vegetation Simulator (FVS) modeling, and the expert opinion or professional judgment of regional office staff. The models that emerged from this refinement process are referred to as the "regional base models." Documentation for the regional base models is available from the Southwestern Regional Office.

In some cases, Gila NF staff were allowed to tailor the regional base models to more accurately describe the current management of the forest. In other cases, Gila NF staff were required to develop inputs for which the region determined were best described by local expert opinion. For this environmental analysis, these inputs as they were in the assessment models were thoroughly reviewed, which resulted in some substantial changes. These model inputs and their development are discussed in detail in appendix B: State and Transition Modeling Process.

The software program used to run the models is the Vegetation Dynamics Development Tool (VDDT) by ESSA Technologies Limited (ESSA Technologies Ltd. 2007). VDDT is a non-spatial user interface that is relatively easy to use and is supported by the Southwestern Regional Office for forest planning. It is a non-equilibrium model, meaning that it characterizes ecosystems as constantly changing—within the user-defined limits. VDDT is in the public domain and available for download on the developer's website[m].

There are many assumptions, limitations, and sources of error associated with state-and-transition modeling generally, and this analysis, specifically. Some limitations or sources of error are associated with datasets or the amount and quality of scientific literature used to structure the model or develop inputs as described by Shlisky and Vandendriesche (2012). However, there are several assumptions underpinning this analysis that specifically merit discussion.

State-and-transition modeling rests on the assumption that the future will look like the past. In other words, there is assumption that all the outcomes, and the likelihood of each are known. While there is arguably potential for disagreement about whether this assumption is valid under a stable climatic regime, there is even more room for debate about its validity, given the fact that our current climatic regime is demonstratively unstable. A stable climate is an assumption specific to the regional base models. Although there are some methodologies in the literature to incorporate projections of future climate into state and transition models, the Southwestern Region has not yet pursued them.

A third assumption is associated with the lack of herbivory-driven transitions. While there is ample scientific literature discussing the interacting ecological effects between herbivory, species composition, woody encroachment and/or fire regimes, the regional base models provide no transition pathways for herbivory in or out of a given state, even though the software is capable of it. This builds in the assumption that herbivory does not affect the trajectory of ecosystems. The decision not to account for herbivory in the models was presumably related to the fact that FVS is not capable of reflecting changes in the herbaceous community, and other difficulties associated with quantifying dynamics. These difficulties include the fact that the agency does not manage herbivory by wildlife, and that herbivory by livestock is driven by allotment-scale analysis and management. Therefore, the only management activities the modeling is able to reflect are wildland fire management and silvicultural activities, with changes occurring only in terms of woody vegetation.

The non-spatial nature of these models is a substantial limitation. Where vegetation communities, their component states, wildland fires and mechanical vegetation treatments are located on the ground and in relationship to each other has a large influence on outcomes. Another substantial limitation is that the models are highly biased toward mechanical vegetation treatments as demonstrated by the general inability to hold reference conditions under reference disturbance regimes (Shahani 2017).

Seral State Proportion

This characteristic describes the proportion of a given ERU in each seral state. It reflects the structural variability in dominant vegetative lifeform (sparsely vegetated, herbaceous, shrub or tree), woody species canopy cover and size class, number of stories or age classes (forest/timberland ERUs only) and compositional status (grasslands only). Structural variability is the result of ecological processes and patterns over time. It reflects of the status of ecological processes, ecosystem function, integrity and resilience, and habitat abundance and quality. All of these things reflect the sustainability of land use practices. The proportion of each ERU in a given state is integral to the definition of each ERU.

In the assessment, the current amount of each state class was compared to what is known about pre-European proportions of state classes, or the reference condition. This analysis compares current and

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[m] https://essa.com/explore-essa/tools/vddt/

modeled future state class diversity to desired conditions. For some ERUs, the reference conditions are the desired conditions. However, given current management issues, including threatened and endangered species and old growth considerations, this is not the case for all ERUs. Some, like Ponderosa Pine Forest, include a relatively small percentage of the landscape with higher tree densities to support habitat requirements for the Mexican spotted owl. Reference and desired conditions for seral state proportions are maintained in the Regional Seral State Proportion Supplement (USDA FS 2016).

Current seral state proportions are an input into the state-and-transition model generated by Gila NF staff. More information on how current seral state proportions are assigned can be found in appendix B: State and Transition Modeling Process. Future seral state proportions are a model output. Both current and future projected seral state proportions are compared to desired proportions and displayed in terms of percent departure from desired conditions. Alternatives are compared to one another based on whether they are trending conditions toward or away from desired conditions. If departure is 33 percent or less, it is within desired conditions.

This characteristic is a reflection used as the basis for grouping alternatives in the effects discussions. Alternatives that result in similar outcomes for seral state proportion are discussed together and compared in terms of their effects on other characteristics.

Coarse Woody Debris and Snag Density

Ecologically, a dead tree is as important as a live one (Stevens 1997; Marcot 2002; among others), because of carbon storage, fuel, and important habitat features. These characteristics are analyzed using coefficients developed by regional office staff. These coefficients provide estimations, and do not necessarily reflect actual amounts that exist in the Gila NF. They are relationships developed between FIA plot data from Arizona and New Mexico national forests for each ERU and seral state. Comparisons are made between desired and projected future average, per acre amounts for the ERU over the modeled time steps to determine trend. These characteristics are only analyzed for forest/timberland and woodland ERUs.

Fire Frequency and Severity

Fire frequency and severity provide a sense of how fire is functioning both as a restoration tool and as a natural ecological process. Model inputs for prescribed fire and wildfire, relative to historic frequency and severity, provide the basis to determine whether or not a particular alternative is moving toward or away from desired conditions (see appendix B: State and Transition Modeling Process). Additional inferences can be drawn about the probability for future undesirable wildfire behavior and effects, not predicted by this modeling effort. These are drawn from the status of seral state proportions, coarse woody debris, and snags. This allows for a coarse evaluation of risk.

Ecological Status

Ecological status is a measure of the species composition of a vegetation community relative to the potential vegetation community. For this analysis, it is assumed that trends in ecological status will follow trends in seral state proportion. If seral state proportion is moving toward desired conditions, than so will ecological status. However, there is a greater degree of uncertainty associated with the analysis of this characteristic, in part due to the model assumption of a stable climatic regime. It is also extremely difficult to predict how it will respond to management activities (Laughlin et al. 2017). Because of this, monitoring and adaptive management for species composition is particularly important under any management scenario. Recall that one of the overarching assumptions made throughout the entirety of the draft environmental analysis is that monitoring sufficient to inform adaptive management occurs (see beginning of chapter 3).

Patch Size

A "patch" is a contiguous area within a particular ERU with similar overstory and canopy cover conditions. This characteristic is only analyzed for the forested ERUs and PJ Woodland due to the volume of data to support reference conditions (USDA FS Gila NF 2017). Trends in patch size are inferred from current departure and trends in seral state proportion.

Patch size is a spatially dependent characteristic, so there is a greater degree of uncertainty associated with its analysis due to the non-spatial nature of the model. There are a few additional considerations that add uncertainty to the analysis. Depending on the ecosystem, patch size can be a reflection of landscape configuration as much as it is indicative pattern, process and function. It is also difficult to predict fire-related changes in patch size given it is not a precise tool like mechanical treatments.

Invasive and Noxious Plant Species

Invasive plants, especially those designated as noxious by the New Mexico Department of Agriculture, can substantially alter plant community composition, landscape structure, and ecosystem functions. In the Gila NF, noxious plant species are not known to exist at detrimental levels. For this qualitative analysis, these species are addressed in terms of risk of establishment and spread. Inferences are drawn based on the amount of mechanical treatments and fire associated with each alternative and their associated effects on the probability for future undesirable wildfire behavior and effects, not predicted by this modeling effort. Ground disturbance increases the risk of establishment and spread proportional to the intensity and frequency of that disturbance, given proximity to a seed source.

Insects and Disease

Also difficult to predict are changes in insect and disease levels. With insufficient information to quantify historical or desired conditions, and no data on which to vary the model inputs among alternatives, these model inputs are held constant, necessitating qualitative analysis. Closed canopy conditions are the most susceptible to epidemic levels of infestation or infection. In these conditions, trees are already stressed by competition for limited nutrients and water. Inferences can be drawn related to the risk posed by insects and disease based on the net change in the amount of area under closed-canopy conditions.

However, insects and disease levels are also dependent on the spatial configuration of tree densities, drought, and in some cases, and winter temperature patterns, none which cannot be predicted by the model. Which creates a higher level of uncertainty associated with this risk evaluation, as compared to those characteristics supported by quantitative analysis.

Characteristics Not Analyzed

Fire Regime Condition Class

Fire regime condition class (FRCC) was a characteristic analyzed in the assessment that was dropped from this analysis. FRCC is an index developed from the analysis of several other of the ecosystem characteristics that are analyzed, such as seral state diversity, fire frequency and severity. Although it is commonly used in fire management analyses, it is fairly redundant here. Perhaps more importantly, when used alone, it has the potential to obscure what is going on in terms of the role fire is playing in a particular ecosystem. This can lead to less effective management. Using an example from the assessment, Ponderosa Pine Forest has an FRCC of III at the forest scale, indicating a high departure from the historical fire regime. However, this is driven by a high departure in vegetation structure (seral state diversity), not fire frequency or severity. Both fire frequency and severity departure from historical are low at the forest scale. More frequent fire isn't going to change the FRCC unless it changes vegetation structure, which means more severity is needed for fire to function as a restoration tool. Alternately, mechanical treatments could be used to alter forest structure. This is not apparent when looking only at FRCC.

Old and Large Trees

Old growth is an important part of landscape ecology and biodiversity conservation. However, because of the complex and dynamic nature of forests, efforts to conserve old growth in landscapes must take into account all developmental stages (Spies 2004). The presence of old trees is just one component of old-growth structure (Binkley et al. 2008), but old-growth forests by definition, have old trees. Old-growth components include old trees, snags, coarse woody debris, and structural variability (USDA FS 2018a).

Old trees are not necessarily large trees. Inferences about age may be made from size, but they are not directly correlated. The correlation between age and size depends on tree species and site conditions (Kaufmann et al. 1992). While some suggest that age and size are correlated sufficiently to analyze this as a characteristic, there is a substantial limitation of the data related to tree size that could lead to under-estimation of old growth. The data product used to classify tree size assigns a size class based on the dominant diameter class of the dominant tree species. Size class categories are 0 to 4.9 inches, 5 to 9.9 inches, 10 to 19.9 inches, and 20 inches and larger. Dominant is defined as being 60 percent of the trees in the area. This means that very large trees could represent up to 40 percent of an area in any other size class category. FIA data could provide a statistical estimate of large trees, but again, large trees are not always old trees.

Coarse woody debris, snag density and structural variability (through seral state proportion) are analyzed. Tree size is not analyzed due to a high likelihood of misrepresenting what is happening in terms of this particular old-growth component in the landscape.

Area Designations

Area designations can influence how the forest manages for ecosystem characteristics. Designations that substantially change the allowable types of activities, equipment, and/or modes of access and travel have the potential to influence the extent and distribution of effects, and at times, the outcomes of management activities. Area designations with this potential include designated wilderness, recommended wilderness, designated and proposed research natural areas (RNAs), IRAs, and other administrative designations. Those effects depend on the designation, amount of area involved, vegetation types and conditions that exist within that area, and the terrain. Terrain can limit the types of activities, equipment and/or modes of access and travel just as effectively as a designation. The effects of proposals or recommendations for new area designations contained within each alternative are discussed qualitatively relative to these management factors and evaluated based on whether they are consistent with opportunities to move toward desired conditions for vegetation communities, fire ecology, and fuels, or whether they detract from those opportunities. Existing designated wilderness and IRAs are not discussed. As these are designated through legislation, they do not contribute to differences in effects among alternatives. Designated RNAs are also not discussed as they create no differences between alternatives. Special botanical areas proposed under alternatives 2 and 5 are not analyzed, as the plan direction for their management does not substantially change the types of activities, disturbances, or associated effects.

Climate Change Impacts

Climate change impacts are primarily considered cumulative effects. The sections discussing the indirect effects of plan direction consider how implementation of a particular alternative addresses those impacts. Impacts can be addressed by promoting resistance to change, resilience to change, and/or realignment to predicted future climate. It is assumed that where departure increases, resistance and resilience decrease. Admittedly, this assumption is problematic where the direction of trend varies among characteristics, and more weight is given to seral state proportion where this occurs.

Effects Common to All Vegetation Types and Alternatives

All alternatives have the same desired conditions for vegetation, including vegetation community structure, composition, pattern, and process[n]. Traditional uses such as the harvest of timber, forest and botanical products, livestock grazing, and dispersed recreation will continue under all alternatives. Each alternative contains a mixture of standards and guidelines promoting movement toward, achievement and maintenance of desired conditions for vegetation communities, the WUI, and wildfire and fuels management.

Fire can restore or maintain landscape heterogeneity and vegetation structure, composition, pattern and processes, or it can do the opposite. It can contribute to nutrient availability, or it can result in a loss of nutrients and soil productivity. It can increase or reduce coarse woody debris and snag density. It can accelerate erosion and sediment delivery to streams and heighten the risk of downstream effects to human life and property; or, it can reduce the risk of future undesirable fire effects, or both. Large extents of stand-replacement fire can result in seed dispersal distances that delay or prevent tree regeneration. The potential for any of these effects depends on many variables, including, but not limited to, fuel and weather conditions, topography, and incident-specific management decisions that influence severity patch size and distribution on the landscape. Because fire is not a precise tool, the full range of these effects is possible under each alternative. However, the degree to which the effects are likely to be mostly beneficial or detrimental vary by alternative.

Detrimental effects are most often the result of high-severity fire, which amplifies runoff and erosion. Regardless, where negative effects occur, Burned Area Emergency Response (BAER) assessments will continue to be conducted in accordance with agency policy under all alternatives, and recommendations will be designed to mitigate unacceptable risks to critical values. Critical values include downstream life and property, riparian and aquatic habitat for threatened or endangered species, water quality, hydrologic function, and soil productivity. Both beneficial and detrimental effects to upland vegetation communities are possible, depending on the BAER treatment. The primary landscape-level BAER treatment is aerial seeding. Seeding and mulching are typically reserved for areas that pose an unacceptable risk to downstream life and property.

Beneficial effects of BAER landscape treatments include reducing the length of time the area is vulnerable to noxious weed establishment and spread, and retention of more nutrient and water

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[n] The Southwestern Regional Office has decided to superimpose the “regionally consistent desired conditions for vegetation” over Alternative 1 – No Action, even though they do not accurately depict current management. This is because many of the desired conditions for vegetation in Alternative 1 originate from an outdated recovery plan for the Mexican spotted owl. Regional Office staff have validated that the new desired conditions remain consistent with the current recovery plan for the Mexican spotted owl.

holding capacity on site by reducing the volume of soil loss. Soil loss can irreversibly alter the physical, chemical, and biological properties of the soil, and in turn, alter the kind and amount of vegetation a site can support. The effects of noxious weed invasion can include displacement of the native vegetation community, a decrease in native species diversity and range, and ecological processes such as fire regimes and nutrient cycling. All of which compromise the integrity of ecosystems, their resiliency and their sustainability. Many noxious weed seeds are dispersed by wind and a proximal seed source is not always needed for recently burned areas to experience invasion. Conversely, seeding and mulching treatments can introduce noxious weed species. This potential is primarily associated with the use of agricultural straw, as the noxious weed-free certification process does not include the laboratory analysis require to certify weed-free seed.

Thinning treatments have repeatedly demonstrated preventing or reducing the potential for detrimental fire effects and enhance many of the beneficial effects. Reducing tree densities can reduce the risk of epidemic levels of insect and disease outbreaks, and potentially lead to positive or negative changes in site moisture characteristics. While natural levels of insects and disease is an important disturbance process that promotes variability in vegetation structure, composition, pattern and process, epidemic levels promote homogeneity. Homogeneous landscapes are not resilient or sustainable. Changes in site moisture characteristics have implications for drought stress and mortality. In the short term, thinning can mitigate water stress (Clark et al. 2016; Bradford and Bell 2017). However, with enhanced growth rates, water demand in the residual trees and understory vegetation increases, as do evaporative losses, which may increase vulnerability to drought over the long term (Brauman et al. 2007; Clark et al. 2016; Moreno et al. 2016). The success of any given thinning intensity to reduce moisture stress will likely differ, based on local site, soil, and stand conditions (Meyer et al. 2007 in North et al. 2009). Because mechanical treatments are a precise tool, they can also allow fire to be reintroduced in areas where without it, unacceptable risk to human values or ecologically undesirable fire effects would be expected.

Regardless of treatment method, reducing uncharacteristic or undesirable tree densities can increase resiliency, both in terms of ecological values and human values associated with the WUI. Ecologically, reducing uncharacteristic tree densities promotes higher herbaceous community cover, productivity and diversity, reduces the risk of undesirable fire behavior and effects, and promotes the ability of the landscape to support beneficial fire. Thinning dense stands can benefit old growth development over time as the health and vigor of residual trees improves. The risk of epidemic insect and disease levels is also reduced. Similarly, repeated occurrences of low and mixed-severity fire can aid in the development of late successional states by reducing seedling and sapling densities, provided there are fire-free periods that allow for uneven-aged dynamics to occur. The combination of prescribed fire and mechanical treatments has repeatedly demonstrated beneficial effects to understory plant communities and nutrient availability over the short term.

Areas that cannot be treated, or cannot be treated frequently enough, are likely to continue experiencing encroachment and infill by woody species; decreasing water availability, nutrients, light and physical space available for understory plant species and reducing their abundance, vigor, and diversity. This also contributes to accumulation of ladder fuels and coarse woody debris.

Ladder fuels facilitate crown-fire, which over larger extents and under extreme weather conditions, is difficult and dangerous to manage. While certain levels of coarse woody debris and snags support nutrient cycling and long-term productivity, too much tends to increase fire duration, behavior, and resistance to control. It also increases the potential for reburn (Brown et al. 2003). Reducing it increases the likelihood that fire effects will result in movement toward desired conditions and present less of a threat to human values, including life. Both fire and mechanical treatments can reduce coarse woody debris, but given wildfire is not subject to utilization standards, it can also create it. Prescribed and naturally ignited fire can also increase snag density, where mechanical treatments are unlikely to do so. Snags eventually become coarse woody debris.

All alternatives have objectives for vegetation communities and the WUI that involve some combination of mechanical treatments, prescribed fire, and naturally ignited wildfire occurring under conditions that support movement toward desired conditions. Under all alternatives, vegetation, fire, and fuels would continue to be managed in accordance with laws and regulations. Naturally ignited wildfires would continue to be managed under fuel and weather conditions that facilitate movement toward desired conditions for all resources, within the operational capacity of the agency. When those conditions are not present, suppression remains an incident objective to limit the extent of undesirable fire effects. The action alternatives provide WUI direction to create conditions that support low-intensity ground fires, reduce wildfire risk to human values, and provide the opportunity for firefighters to safely and efficiently suppress wildfire. Although alternative 1 does not contain plan components that specifically address the WUI, management would be similar to that of the other alternatives because national interagency wildland fire policy and Forest Service policy provide similar guidance.

The differences in the environmental consequences of the alternatives are primarily tied to vegetation types, treatment methods, and number of acres proposed for treatment. This results in differences related to the risk of epidemic levels of insect and disease, and invasive and noxious species establishment and spread. Differences in the amount of land area proposed for new area designations also contributes to differences among alternatives, as it influences the use of mechanical treatment methods.

While herbicide is not included in any of the treatment objectives, its use is allowable under all alternatives as part of an integrated weed management approach. Even though the action alternatives contain standards and guidelines guiding its use and alternative 1 does not, there is no difference in ecological effects as the standards reiterate law and regulation. While it is not necessary to reiterate law and regulation, it is useful to include these in plan direction as a matter of communication with stakeholders who are concerned about the use of chemicals and may or may have familiarity with the law or regulatory procedures. The action alternatives also include standards and a guideline that do not reiterate law and regulation related to public notification, monitoring, and reporting, but the effects are social, not ecological. Providing for communication and transparency to the highest extent possible will help improve relationships.

The effects of herbivory are well documented in the scientific literature, and the degree to which the outcomes are mostly beneficial or detrimental depend on how it is managed. Herbivory by wildlife and permitted livestock will continue to influence species composition and nutrient cycling under all alternatives. Herbivory can stimulate new growth, but over-grazing reduces vigor and productivity. At any level, it reduces the amount of material available to create litter, which is important to keeping nutrient levels sufficient for plant growth. Compaction caused by wildlife or permitted livestock can decrease water-holding capacity on clayey soils and increase it sandy soils. Decreases in water holding capacity reduces plant vigor and productivity. With heavy grazing pressure, all of this interferes with the ability of the herbaceous community to compete against woody encroachment and support natural fire regimes. All alternatives contain plan direction designed to promote beneficial outcomes. However, detrimental effects are still likely to occur across relatively small areas or time periods under every alternative. Difference between alternatives arise from how vacant allotments are managed.

Recreation, especially dispersed recreation, is another traditional use of the forest. Most impacts are minor and localized (USDA FS Gila NF 2017). The most substantial effect to vegetation communities as a result of recreation is human-caused wildfires. The negative effects of fire previously discussed are more likely to result from human-caused wildfires. Projected increases in visitation could lead to an increase in these types of fires.

Roads and trails have and will continue to provide access for all of these traditional uses and management activities under all alternatives. Their ability to be used for fire management purposes facilitates restoring beneficial fire to the landscape and suppression of undesirable fire, which supports movement toward desired conditions for vegetation. They also serve as vectors for the introduction of non-native invasive and noxious species, the effects of which have been discussed previously.

Roads and trails require the removal of vegetative cover within the road or trail prism and reduction or removal of vegetation in rights of way alongside the road, but these effects are relatively localized. However, roads in particular have disproportionate effects on soil and hydrologic processes which alter the distribution of plant available water and nutrients on a particular site. This can influence fine-scale patterns of nutrient cycling, species composition, abundance, and vigor. While there are differences between the alternatives in terms of how the transportation system is managed, and differences between related to the effects on other natural resources, the effects to vegetation communities and fire management do not lead to substantial differences between alternatives.

Effects Common to All Vegetation Types and Alternative 1

In terms of vegetation treatments, alternative 1, the no-action alternative, represents the continuation of current management. This means the relative emphasis placed on each ERU and treatment method remain the same. While treatments occur in most vegetation types, Ponderosa Pine Forest receives the emphasis.

The continuation of current management also means that prescribed fire continues to target the state classes it has in the past, and that the likelihood of using any particular wildfire to move toward desired conditions is the same as it has been. Typically, the state classes targeted with prescribed fire are already open canopy. In forest/timberland ERUs, this has also included closed canopy, single storied state classes as the generally low levels of ladder fuels present little risk in terms of the occurrence of mixed- or high-severity under typical prescribed fire weather conditions. Prescribed fire does reduce coarse woody debris and serves to maximize the beneficial effects of mechanical treatments as previously described, but it isn’t functioning as a restoration tool in the sense that it is not being used to intentionally change canopy cover conditions. Although the acres treated are based only on what can be accomplished with congressionally allocated dollars, and the potential for additional acres of treatment could be possible with the help of partners, wildfire remains the dominant change agent.

Alternative 1 directs management to address noxious plants using integrated pest management practices, but provides no further guidance. Integrated pest management includes physical removal, herbicide, and biological agents to control, contain, and/or eradicate invasive and noxious species. While sound, this guidance provides little benefit if populations are not detected early and response is rapid. This increases the risk that ecological integrity and resiliency could be compromised by invasive or noxious species.

Alternative 1 also defines geographic areas, often with different management direction, which artificially fragments the landscape and creates unnecessary complexities to project design. Restoration projects are more likely to contribute to ecological sustainability if they consider ecological relationships and spatial variability across the forest as a whole.

Effects Common to All Vegetation Types and Alternative 2

Alternative 2 continues to distribute treatments across most ERUs, but increases the emphasis on Mixed Conifer-Frequent Fire over alternative 1. This ERU has received little treatment in the past and there is a perceived opportunity to benefit both this ERU, as well as Mixed Conifer with Aspen by treating it. Alternative 1 increases the use of prescribed and naturally ignited wildfire, leading to more acres experiencing fire and more acres treated. It also allows for more mixed-severity prescribed fire on the landscape, and expands state classes targeted to include closed canopy state classes, both single and multi-storied. Research has suggested that for fire to function effectively as a restoration tool in ponderosa pine-dominated ecosystems, more mixed-severity fire is needed (Huffman et al. 2017; Huffman et al. 2018). Acres treated are based on only what the forest can accomplish with congressionally allocated dollars. The objectives for alternative 2 are flexible, allowing for more acres of mechanical treatments and prescribed fire, should partnership contributions allow.

While prescribed fire functions more as restoration tool, as opposed to alternative 1, wildfire remains the dominant change agent and the full spectrum of the fire effects described previously are likely. Increasing the emphasis on prescribed fire and allowing for more mixed-severity necessitates greater risk and larger patches of high-severity fire are possible, even if they are unintended. Using wildfire as a treatment tool more often than under alternative 1 also increases the risk of high-severity fire and its associated detrimental effects, at least over the life of the plan. As open-canopy conditions increase over time, this risk will be reduced over alternative 1.

Alternative 2 retains vacant allotments in that status, on a case-by-case basis, to provide an alternative source of forage for current permit holders during drought years, before or after fire, and under other circumstances that might render a portion or all of a permitted allotment unusable. This provides a measure of flexibility to plan and implement mechanical and prescribed fire treatments, recourse to address the resource conflicts that can arise during drought, and accelerates the rate at which management is able to move vegetation communities toward desired conditions.

Prescribed fires can be more effective at reducing tree densities if sufficient fine fuels are available to produce flame lengths capable of causing tree mortality. Provided time to recover from mechanical treatments and/or prescribed fire, the herbaceous community response to increased nutrient, light, and water availability is often more vigorous and lasting. During drought, herbaceous production declines and plants become more vulnerable to multiple stressors. Especially in severe drought, the ability to rest an allotment in these conditions, moving to one that has been rested, minimizes plant stress, preserves resilience, and will maintain or increase productivity over the long term.

Effects Common to All Vegetation Types and Alternatives 3 and 4

Alternatives 3 and 4 are similar to alternative 1 in terms of wildfire management, but both limit the use of prescribed fire in favor of more mechanical treatments. This means fewer acres are treated overall as mechanical treatments are far more expensive than prescribed fire. Alternative 3 only treats historically open woodlands and encroached grasslands. Other ERUs are treated only in the WUI, proportionally to the extent they are represented in the WUI. Alternative 4 is similar to alternative 3, except forest/timberland ERUs are the focus outside of WUI.

Acres treated are based on only what the forest can accomplish with congressionally allocated dollars, and the focus of both alternatives is on providing products to people. This limits the number of acres that can be treated, both within and outside the WUI. Both allow for more acres of mechanical treatment should partners contribute, but the acres of prescribed fire are capped. As a result of limiting prescribed fire, the understory plant community would have less response to mechanical treatments, and shrubs are likely to be favored over herbaceous species (in sensu Goodwin et al. 2018). While both alternatives 3 and 4 would provide progress toward seral state proportions in one or more vegetation types, there are differences between then in terms of how well they mitigate the risk of large contiguous extents of high-severity wildfire. These differences are discussed subsequently and relative to each ERU.

These alternatives also prioritize stocking vacant allotments to the maximum extent possible. This limits flexibility, leaves no recourse to address drought, and slows the rate at which management is able to move vegetation communities toward desired condition.

Effects Common to All Vegetation Types and Alternatives 5

Alternative 5 is similar to alternative 2 in the way prescribed fire and wildfire are used, but the emphasis is increased. It is dissimilar from alternative 2, as it restricts mechanical treatments to the WUI, unless there is compelling, scientific site-specific analysis that suggests such treatment would allow more beneficial fire on the landscape. Objectives focus on historically frequent-fire ecosystems, and providing products to people is a secondary consideration. Similar to the other alternatives, more acres could be treated with prescribed fire, should partnerships enable that to happen. Also, more mechanical treatments could occur should site-specific analysis meet the terms described previously—provided partnership dollars were available to fund them. Given more fire on the landscape and near exclusion of mechanical treatments, high-severity fire and its associated detrimental effects are more likely, at least over the life of the plan. The risk is greater than under alternative 2. However, as more acres are treated and open-canopy conditions increase in prevalence, over time this risk will decline as opposed to the other alternatives.

Alternative 5 also retains vacant allotments in that status, and unstocked, until site-specific environmental analysis is completed to evaluate issues and restoration needs, and to determine future management and uses. This provides the same beneficial effects described under alternative 2, but only for the vacant allotment rather than for multiple allotments.

Effects Common to All Vegetation Types and Alternatives 2, 3, 4, and 5

These alternatives direct the use of integrated pest management practices, but include fiscally achievable minimum objectives for detection, monitoring and treatment. This reduces the risk of establishment and spread, and prevents or minimizes potential alterations to native plant community composition, landscape structure and ecosystem functions. While plan direction allows for early detection and rapid response, success will ultimately depend on whether project-level environmental analysis is completed in time to implement effective treatments. Treatments are more likely to be successful on smaller populations, and therefore, they are time-sensitive. Maintaining plant communities dominated by native species maintains ecological integrity and resiliency.

These alternatives also include several standards and guidelines for preventing introduction of invasive or noxious species as a result of management activities and for minimizing ground disturbance whenever possible. The seeds of many invasive or noxious plant species are dispersed by wind and can already be in the seedbank, ready for ground disturbance to give them the competitive advantage.

While alternative 1 does not prohibit forest staff from participating in collaborative education programs, it does not encourage it. All the action alternatives include direction for forest staff to participate in collaborative, community education programs that could help raise awareness and shared understanding of ecological and fire management issues, cultivate the younger generation's interest in public land management, build and maintain strong relationships, and expand the skill sets and resources contributing to the management of the Gila NF. These social outcomes increase the ability of the Gila NF to get work done on the ground that will move vegetation conditions, within and outside the WUI, toward desired conditions.

Alternative 1 is also silent on the management of vacant allotments, leaving it a matter of agency policy and district ranger decisions. The action alternatives provide direction on the management of vacant allotments, consistent with agency policy. The direction, and its effects to vegetation communities and their fire ecology varies among alternatives.

None of the action alternatives includes geographic areas as alternative 1 does. This increases the ability of projects to consider the ecological relationships between vegetation communities within the project area, and across the forest as a whole. As a result, the ability of projects to promote spatial variability and connectivity, both of which increase resilience and may promote resistance to predicted future climate.

Effects to Spruce-Fir Forest

Spruce-Fir Forest is generally characterized as an infrequent, high-severity disturbance ERU. It occurs on the coldest, wettest and highest-elevation sites in the forest, along a variety of slope gradients including gentle to very steep mountain slopes. Although it occupies just 1 percent of the forest, it has substantial ecological value in terms of biodiversity (see Wildlife and Botanical Species). Ninety-one percent of the ERU is located in existing designated wilderness. Potential treatment methods in wilderness are limited to naturally ignited wildfire. Prescribed fire is not allowed for ecological benefit, only for fire management purposes. Between 2012 and 2013, substantial area previously in mid to late seral state moved to early seral states as a result of wildfire. Its current seral state departure from desired conditions is estimated at 46 percent. Ecological status is in high departure from the reference due to the extent of stand-replacement fire. Patch size is currently smaller than desired, with a moderate departure. Coarse woody debris is currently higher and snag densities are lower than desired conditions, which are an average of 30 tons per acre and 8 per acre, respectively. Current amounts of coarse woody debris are estimated at an average of 44 tons per acre and average of 2.5 per acre and 68 percent, respectively.

No treatments have occurred in this ERU, and would not occur under alternative 1. Prescribed fire was not modeled, given the primary intent of prescribed fire would be to reduce coarse woody debris, not overstory canopy cover. Reducing coarse woody debris could help lower the risk of losing all the regenerating conifer to re-burn, thus promoting the development of structural variability into the future. The model is not capable of showing this, given the methodology used to analyze coarse woody debris is dependent on changes in seral states. No treatment objectives are proposed as part of any of the remaining alternatives. Model results are presented in the following figure and discussed under the subsequent effects headings.

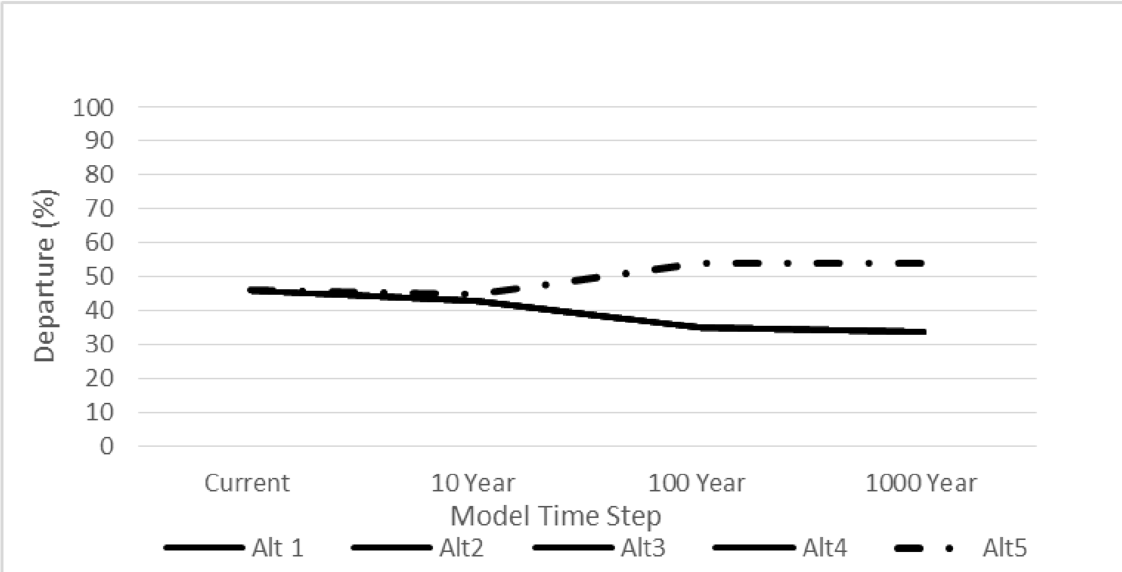

Figure 13. Spruce-fir forest seral state proportion departure from desired conditions

Alternatives 1, 2, 3, and 4

Spruce-Fir Forest is projected to move slowly toward desired conditions for seral state proportion, ecological status, patch size, and snag density over time under all of these alternatives. It is projected to move away from desired conditions for coarse woody debris. This increases the potential for reburn in areas where tree regeneration is occurring, which could set-back or reverse projected trends in seral state proportion. Fire frequency and severity are likely not in departure from historical or desired conditions (Margolis et al. 2011, Schoennagle et al. 2004) although recent fire events are certainly in departure from contemporary human experience. Movement toward desired conditions inherently carries with it a higher risk of epidemic levels of insect and disease as tree densities recover from stand-replacement fire. The risk of invasive and noxious species establishment and/or spread is likely to become elevated in burned areas, increasing with severity, extent and proximity to roads and trails, but the differences among these alternatives are negligible.

While the model shows a difference between these alternatives and alternative 5, this may not play out in reality. With an emphasis on firefighter safety, management is unlikely to send them in to remote areas full of snags and downed logs to manage a fire, under any fire weather conditions. This could lead to more acres being burned under these alternatives than represented in the model.

Any prescribed fire that may occur under alternative 2 could include aerial ignitions in early spring, which carries with it a certain amount of risk. Fire can smolder for long periods of time under these conditions. While the best case scenario is that this would result in small patches of coarse woody debris reduction, if the fire remains active when the spring winds kick up and moisture conditions decline, more extensive and intense fire is a possibility. Should this occur, the projected trend toward desired conditions for seral state proportion, ecological status and patch size could be set back or reversed. In the best case scenario, coarse woody debris reductions over time could promote the development of structural variability and increase resistance to climate change. Given a very high vulnerability to climate change, the worst-case scenario could represent a management-facilitated transition, or realignment of this ecosystem to predicted future climate. Realignment is not consistent with the desired conditions for vegetation. Even though alternative 2 remains within historical fire frequencies, in a warmer, drier climate, longer fire-free periods will likely be necessary for successful regeneration (Enright et al. 2015).

Overall, there are no substantial differences between alternatives 1, 3, and 4 in their ability to promote resistance and resilience under future climate. Alternative 2 has a slightly higher ability to do so, but also carries more risk of realignment.

Alternative 5

Still within what is known of the historic fire regime, this alternative allows for approximately nine times more wildfire as compared to alternative 1. More frequent fire use, with or without an objective for this particular ERU, leads to fire on the landscape, thus the difference in projected outcomes. Those outcomes are likely to include movement away from desired conditions for seral state proportion, ecological status and patch size, and relative maintenance of current departure for coarse woody debris and snag density. The insect and disease risk will decline, but the risk of invasive plant species establishment and spread may be more persistent. This alternative is accompanied by a greater risk of realignment than alternative 2.

Effects to Mixed Conifer with Aspen

Mixed Conifer with Aspen is also generally characterized as an infrequent, high-severity disturbance ecosystem. It occurs between the Spruce-Fir Forest ERU at its upper elevational limit and the Mixed Conifer-Frequent Fire ERU at its lower elevational limit, along a variety of slope gradients including gentle to very steep mountain slopes. Although it occupies just 2 percent of the forest, it has substantial ecological value in terms of biodiversity (see Wildlife and Botanical Species). Most of this ERU is located in existing designated wilderness, IRAs, or on steep slopes and/or on more erodible soils. However, there is a greater opportunity to use a wider range of treatment methods on more acres than in Spruce-Fir Forest. Similar to Spruce-Fir Forest, Mixed Conifer with Aspen has experienced substantial wildfire activity over that last decade. Its current seral state departure from desired conditions is estimated at 40 percent. Ecological status is in high departure and patch sizes are smaller with a moderate departure, also due to wildfire activity. Coarse woody debris and snag densities are currently higher than desired conditions, which average 31 tons per acre and 4 per acre, respectively. Current amounts of coarse woody debris are estimated at 70 tons per acre, with snag density averaging 6 per acre.

Mechanical and prescribed fire treatment acres used in the models are presented in table 7. Wildfire acres are not included as this is better presented as a likelihood, or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 14 displays model results. This information is referenced in the subsequent discussion of effects.

Table 7. Acres treated per decade modeled for mixed conifer with aspen under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	336	353	53	353	195
Prescribed Fire	0	200	0	20	0

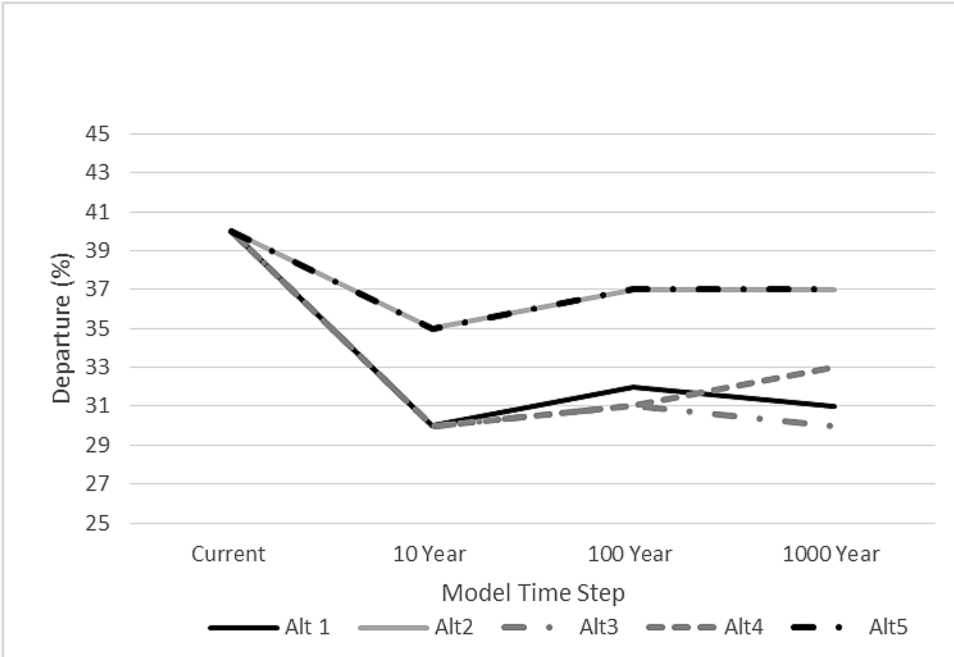

Figure 14. Mixed conifer with aspen seral state proportion departure from desired conditions

Alternatives 1, 3, and 4

Despite differences in treatment methods and acres treated, projected outcomes for all these alternatives include movement toward desired conditions for seral state proportion, with only a 3 percent difference between them at the end of the 1,000-year model run. All three of these alternatives result in seral state proportions being within desired conditions by the end of the first decade. Ecological status and patch size are also expected to trend toward desired conditions. Relatively small differences between trends in coarse woody debris and snags under these alternatives are negligible. Fire frequency and severity are likely within desired conditions (Margolis et al. 2011), and would remain so under all of these alternatives. These three alternatives perform the best in terms of movement toward desired conditions, resistance and resilience to climate change, and avoiding unintentional realignment.

The risk of epidemic levels of insects and disease is projected to increase under alternatives 1, 3, and 4, as movement toward desired conditions for seral state proportion include increases in closed-canopy conditions. The risk of invasive and noxious species establishment and/or spread is likely to become elevated in burned areas, increasing with severity, extent, and proximity to roads and trails. Alternatives 1 and 4 include mechanical treatments, so the risk of invasive and noxious species establishment and/or spread is higher than alternative 3, as proximity to roads is almost always a prerequisite for those treatments to be implemented.

Alternatives 2 and 5

Both of these alternatives trend seral state proportions, ecological status, patch size, and coarse woody debris toward desired conditions, with improvements in coarse woody debris being comparable to the other three alternatives. However, seral state proportions do not move within desired conditions at any modeled time step, in contrast to alternatives 1, 3, and 4. Similarly, ecological status and patch size are not expected to move within desired conditions. Snag density trends away from desired conditions under alternatives 2 and 5. While more fire on the landscape improves coarse woody debris conditions, there is also likely to be more tree mortality, and therefore, higher rates of snag recruitment. Fire frequency and severity remain within desired conditions (Margolis 2011). The risk of epidemic levels of insects and disease declines slightly, rather than increasing, based on reductions in closed-canopy conditions as opposed to the other alternatives. However, the risk of invasive or noxious plant establishment and/or spread is higher with both of these alternatives, and highest for alternative 5, based on the number of acres experiencing wildfire. Overall, both of these alternatives promote progress toward desired conditions, resistance and resilience to climate change, but risk unintentional realignment.

Effects to Mixed Conifer-Frequent Fire

As indicated by the name of this ERU, Mixed Conifer-Frequent Fire is characterized as a frequent, low-severity disturbance ecosystem. It is transitional between the warmer, drier Ponderosa Pine Forest and/or Ponderosa Pine-Evergreen Oak ERUs and cooler, wetter Mixed Conifer with Aspen. In the Gila NF, it typically occurs on steep slopes (40 percent or greater), although it is occasionally found on gentler terrain. This ERU represents 12 percent of the forest and is more common than it is in the surrounding landscape. This provides the forest a greater opportunity to contribute to the integrity and sustainability of this ecosystem.

Its current seral state departure from desired conditions is estimated at 55 percent, due to more closed-canopy conditions, lower densities of larger trees, and higher densities of seedling, sapling and small-sized trees. Ecological status is in moderate departure. Patch size is within desired conditions. Coarse woody debris is substantially higher than desired conditions (7.5 average tons per acre) at an estimated average of 61 tons per acre. Snag densities are estimated to be similar to desired conditions, with an average of 3 per acre.

There are a few important things to consider with respect to seral state departure. Fire frequency has a low departure from desired conditions and severity has been higher, with a moderate departure (USDA FS Gila NF 2017). The data used to establish reference and desired conditions for this ERU are largely from northern Arizona (Reynolds et al. 2013). Most of studies from which the data were derived discuss the rock type the soils developed on, but provide little or no discussion about topographic site characteristics. Data obtained from a recent study, which included many of the same sites used to develop the reference and desired conditions as well as eight new sites (Rodman et al. 2017a), reveals 82 percent of the reference sites occur on slopes less than 20 percent (Rodman et al. 2017b). The remaining sites ranged between 20 and 40 percent slope, with only one at 40 percent (Rodman et al. 2017b). This study found that, historically, the number of trees per acre increased with slope (Rodman et al. 2017). Increasing slope has long been associated with increasing tree (and fuel) density, with slope and other topographic factors often being used as a surrogate for live fuel density (in sensu Parks et al. 2018a). With 73 percent of this ERU, as it is currently mapped, being located on slopes greater than 40 percent, there is some uncertainty about the magnitude of departure. Furthermore, greater slopes have greater surface area per acre as standard land survey practices measure only the horizontal distance between two points, not true ground distance. Unless a correction is applied, this leads to overestimation of tree density on sloped land. Of course, there are other variables that influence historical and current tree densities, with soil, precipitation, and the direction the slope faces (aspect) being prime among them.

The uncertainty associated with magnitude of departure from desired seral state proportions has implications for uncertainty associated with the departure in fire severity, as steep slopes and higher tree densities influence fire severity. However, the direction of fire spread is also a major factor in determining severity patterns. The direction of fire spread is beyond the ability to consider for this analysis.

Mechanical and prescribed fire treatment acres used in the models are presented in table 8. Wildfire acres are not included, as this is better presented as a likelihood or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 15 displays model results. This information is referenced in the subsequent discussion of effects.

Table 8. Acres treated per decade modeled for Mixed Conifer-Frequent Fire under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	626	7,152	277	12,777	1,028
Prescribed Fire	4,743	10,000	0	2,000	5,500

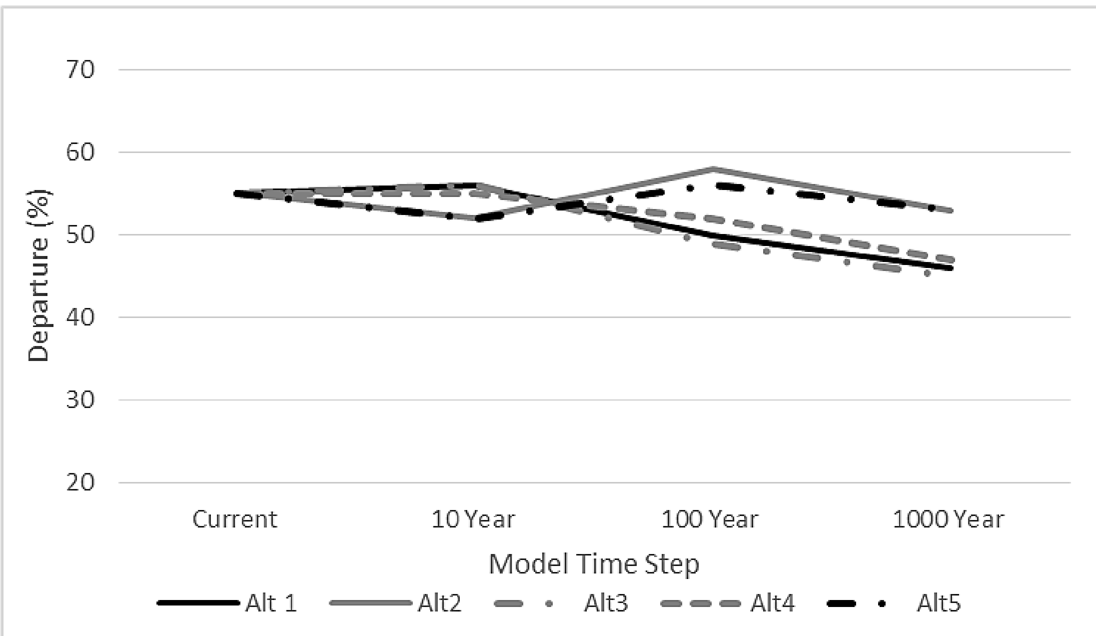

Figure 15. Mixed conifer-frequent fire seral state proportion departure from desired condition

Alternatives 1, 3, and 4

All of these alternatives move seral state proportions, ecological status and coarse woody debris slowly toward desired conditions and maintain patch size within desired conditions. Snag densities increase, moving away from desired conditions. Alternative 1 maintains the current low departure from desired conditions in terms of fire frequency, and alternatives 3 and 4 move it away from desired conditions. In terms of severity, the moderate departure originates from wildfire and will likely be maintained given slow rate of progress toward desired structural conditions. The risk of epidemic levels of insect and disease infestation remains unchanged under alternatives 1 and 3, but decreases slightly under alternative 4. The risk of invasive species establishment and/or spread is likely to remain at current levels under alternative 1, but may increase under alternative 4 and decrease under alternative 3. These changes are the result of more ground disturbance under alternative 4 and less under alternative 3.

Alternatives 2 and 5

The progress toward desired conditions for seral state proportion provided by these two alternatives is negligible, with only a 2 percent improvement over current conditions at the end of the 1,000-year model run as opposed to the 8 to 10 percent improvement provided by alternatives 1, 3, and 4. This difference is due to an increase in open canopy, single-storied state classes that are not part of the desired condition. These state classes represent a greater prevalence of even-aged dynamics than are believed to be characteristic of the reference period, which only included a small proportion of closed canopy, single-storied state classes (approximately 5 percent). Even-aged stands are generally not as resilient as uneven-aged stands. Coarse woody debris is expected to decline, moving toward desired conditions. Snag density is expected to increase, moving away from desired conditions. Both trends are primarily associated with fire.

Even with the substantial increase in fire frequency, this alternative maintains that characteristic within desired conditions. Fire severity is likely to remain higher than thought to have been historically, and by virtue of allowing for more mixed-severity prescribed fire, these alternatives increase that departure. Given the reduction in closed-canopy conditions, these alternatives substantially reduce the risk of epidemic levels of insects or disease. However, the risk of invasive and noxious species establishment and/or spread is greater than alternatives 1, 2, or 4 because of more disturbance. While these alternatives move more area into open-canopied state classes, thereby, promoting resistance and resilience to climate change, they also risk unintentional realignment as longer fire-free periods will likely be necessary for regeneration to occur (Enright et al. 2015). This risk is greatest under alternative 5.

Effects to Ponderosa Pine Forest

Ponderosa Pine Forest includes two sub-types: Ponderosa Pine-Bunchgrass and Ponderosa Pine-Gambel Oak. In the Gila NF, this ERU includes relatively small areas where Arizona or Apache pine is the dominant. This generally occurs on soils formed on rhyolite and tuff within the Gila and Aldo Leopold Wildernesses. As a whole, this ERU represents about 19 percent of the forest and is more common than in the surrounding landscape. This provides a greater opportunity for management to contribute to its integrity and sustainability.

Its current seral state departure from desired conditions is estimated at 79 percent, due to more closed-canopy conditions, lower densities of larger trees, and higher densities of seedling, sapling, and small-sized trees. Ecological status is in moderate departure. Current mean patch size is 71 acres versus the desired 0.02- to 1-acre mean patch size. Coarse woody debris is currently higher than desired conditions (average 9 tons per acre), with an estimated average of 42 tons per acre. Current and desired snag densities average 0.8 per acre. Fire frequency has a low departure from historic and desired conditions, as does fire severity.

Mechanical and prescribed fire treatment acres used in the models are presented in table 9. Wildfire acres are not included, as this is better presented as a likelihood or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 16 displays model results. This information is referenced in the subsequent discussion of effects.

Table 9. Acres treated per decade modeled for ponderosa pine forest under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	10,437	7,404	1,084	30,314	3,969
Prescribed Fire	51,656	5,508	0	12,600	55,000

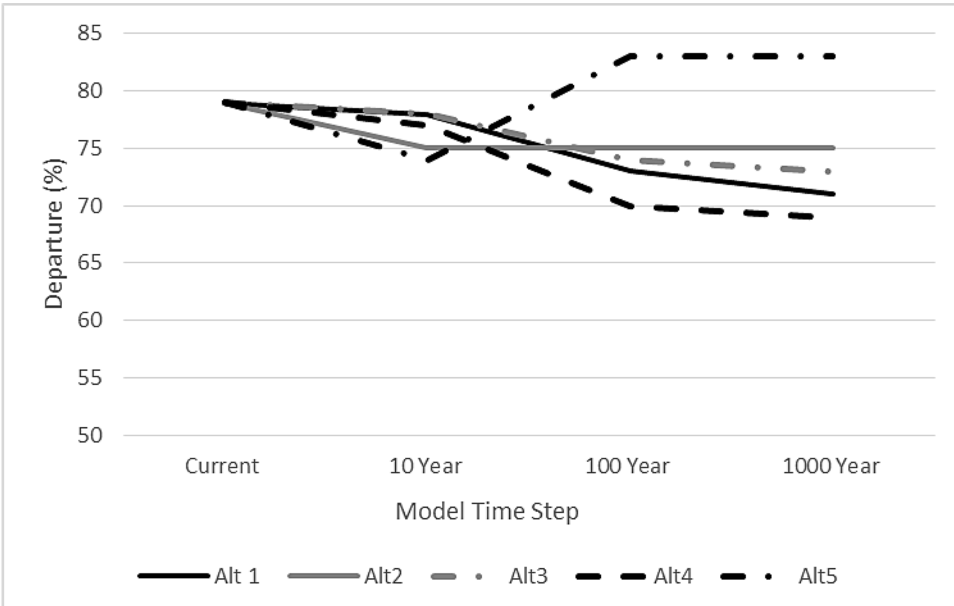

Figure 16. Ponderosa pine forest seral state proportion departure from desired conditions

Alternatives 1, 2, 3, and 4

Despite the differences in what these alternatives do, they are relatively similar in their effects to seral state proportion, ecological status, and patch size. All produce a slight trend toward desired conditions up to the end of the first decade. However, in subsequent decades, the progress made under alternative 2 stops, and the level of departure is maintained. Of the other three alternatives, alternative 4 performs the best in terms of seral state proportion and ecological status, but only by a margin of 2 percent as compared to alternative 1, and 5 percent over alternative 2. However, there is some uncertainty around these results and alternative 2 related to the limitations of the model and current patch size departure.

Following the regional protocol, areas in grass/forb/shrub states are placed in an early seral state. The desired condition is for no more than 2 percent of the ERU to be in this state. Under alternative 2, there is substantial area going to grass/forb/shrub, which is the reason progress toward desired conditions stops after the first decade. Current mean patch sizes are 71 acres, as opposed to the desired 0.0- to 1-acre patches (USDA FS Gila NF 2017). Given no spatial context in the model and current high departure in patch size, it is possible that the areas being assigned to the early seral state are equally likely to represent openings within mid- to late-seral states, and therefore, greater progress toward desired conditions for patch size.

Under all of these alternatives, snag densities increase, moving away from desired conditions either as a function of fire on the landscape, or the absence of it. Under alternatives 3 and 4, coarse woody debris continues to increase, moving further away from desired conditions due to decreases in prescribed fire, which results in fewer acres treated overall. This characteristic moves toward desired conditions under alternatives 1 and 2, as both include prescribed fire, and thereby, treat more acres. Alternative 2 outperforms alternative 1 in terms of coarse woody debris by a factor of 2 because of the 5-fold increase in the acres treated with wildfire and because it allows for more mixed-severity prescribed fire.

In terms of fire frequency, alternative 2 is the only one that maintains this characteristic within desired conditions, which reduces the risk of undesirable wildfire behavior and effects, and increases resilience. The reason fire frequency is currently within desired conditions is because of partnership investments in prescribed fire. Even considering the current use of wildfire, without partnership investments, movement away from desired conditions is likely under alternative 1. Alternatives 3 and 4 are likely to create movement away from desired conditions associated with reductions in or elimination of prescribed fire and increases in coarse woody debris. Risks to ecological integrity and sustainability are greater as compared to alternatives 1 and 2.

In terms of fire severity, alternative 1 maintains this characteristic within desired conditions over the short term, but does less to mitigate the risk of undesirable wildfire behavior and effects as compared to alternative 2. Alternative 2 targets more difficult, expensive acres with mixed-severity fire, which creates movement away from desired conditions to use fire as a restoration tool. Alternatives 3 and 4 maintain fire severity within desired conditions, but the risk of undesirable wildfire increases with fewer acres treated overall.

The risk of epidemic levels of insects and disease is best reduced by alternative 2, followed by alternative 1. Alternative 3 does little to reduce this risk. It is more likely alternative 3 will reduce the risk of invasive and noxious weed establishment, provided no unforeseen wildfire, as it creates the least ground disturbance. Risk is highest for alternatives 2 and 4, given more ground disturbance, and may be highest for alternative 4, as treatment areas require close proximity to roads.

Of these alternatives and overall, alternative 2 likely performs the best in terms of movement toward desired conditions and promoting resistance and resilience to climate change.

Alternative 5

Similar to alternative 2, interpretation of the model results for alternative 5 requires consideration of current patch size, the non-spatial nature of the model, and the regional protocol. Following the regional protocol, areas in grass/forb/shrub states are placed in an early seral state. The desired condition is for no more than 2 percent of the ERU to be in this state. Under alternative 2, there is substantial area going to grass/forb/shrub, which is the reason progress toward desired conditions stops after the first decade. Current mean patch sizes are 71 acres, as opposed to the desired 0.02- to 1-acre patches (USDA FS Gila NF 2017). Given no spatial context in the model and current high departure in patch size, it is possible that the area being assigned to the early seral state are equally likely to represent openings within mid- to late-seral states, and therefore, greater progress toward desired conditions for patch size. Considering the two equally likely interpretations of the model results adds difficulty and additional uncertainty to inferences that could be drawn about trends in ecological status.

Alternative 5 performs the best at reducing coarse woody debris and moving toward desired conditions. Similar to the other alternatives, snag density increases, moving away from desired conditions, but to a lesser degree than the other alternatives. This amount of fire on the landscape is still within historic frequencies, and therefore, desired conditions, but severity moves away from desired conditions and to a greater degree than alternative 2. Overall, this alternative does the most to promote resistance and resilience to climate change, but again, longer fire-free periods are likely necessary for successful regeneration in a warmer, drier climate (Enright et al. 2015), which increases the risk of unintentional realignment under this alternative. The risk of epidemic levels of insects and disease is the least of all the alternatives, with the risk of invasive or noxious weed establishment and spread being higher than the other alternatives due to more ground disturbance.

Effects to Ponderosa Pine-Evergreen Oak

The Madrean influenced Ponderosa Pine-Evergreen Oak is similar to Ponderosa Pine Forest, but is generally a little warmer and drier. It remains dominated by ponderosa pine, but with slightly more even-aged dynamics and one or more well-represented evergreen oak species such as Emory oak, silverleaf oak, gray oak, turbinella oak, or Arizona white oak. Other woodland species are present, including juniper and piñon. Ponderosa Pine-Evergreen Oak has two subclasses, one with a more continuous layer of perennial grasses, forbs, and a few shrubs, and one with an understory dominated by native evergreen shrubs. In the Gila NF, this ERU includes relatively small areas where Arizona, or Apache pine is dominant. This typically occurs on soils formed from rhyolite and tuff. Ponderosa Pine-Evergreen Oak is relatively common, representing 12 percent of the forest and providing a greater opportunity for Gila NF management to contribute to ecological integrity and sustainability.

Its current seral state departure from desired conditions is estimated at 43 percent, due to more closed-canopy conditions; lower densities of larger trees; and higher densities of seedling, sapling and small-sized trees. Ecological status and patch size are within desired conditions. Coarse woody debris is estimated to be higher than desired conditions, with an average of 34 tons per acre as opposed to an average of 4 tons per acre. Snag densities are also higher than desired, with 2 per acre rather than 1 per acre. However, fire frequency has a low departure from historic, as does fire severity. Fire severity is a little higher than it was historically, which may indicate the presence of a stronger oak component.

Mechanical and prescribed fire treatment acres used in the models are presented in table 10. Wildfire acres are not included as this is better presented as a likelihood, or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 17 displays model results. This information is referenced in the subsequent discussion of effects.

Table 10. Acres treated per decade modeled for ponderosa pine-evergreen oak forest under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	5,876	1,554	554	30,314	3,969
Prescribed Fire	37,187	33,411	0	2,000	55,000

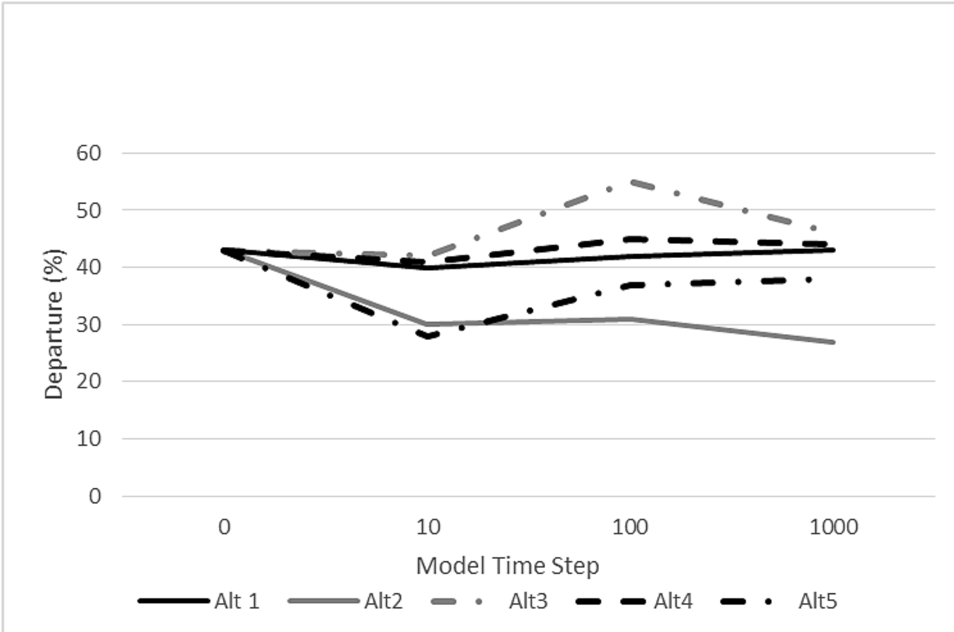

Figure 17. Ponderosa pine-evergreen oak seral state proportion departure from desired condition

Alternatives 1, 3, and 4

Despite very different approaches, these three alternatives result in similar outcomes in terms of seral state proportion, with only a few percentage points separating them at the 1,000-year time step. All three essentially maintain existing conditions for seral state proportion, patch size, and ecological status, although alternative 3 does generate movement away from desired conditions for a period of time. Coarse woody debris and snag densities both increase, moving away from desired conditions under these alternatives, although that trend is least pronounced for alternative 1 and greatest under alternative 3. Similar to Ponderosa Pine Forest, fire frequency is expected to decline, moving away from desired conditions under these alternatives. Alternative 1 has the potential to maintain low departure, but not without partnership investments or increased use of wildfire. All of these alternatives maintain existing severity, but the risk of more high-severity fire and movement away from desired conditions increases due to increases in coarse woody debris and snags. The existing proportion of this ERU in closed-canopy conditions remains relatively constant, and is not projected to be the deciding factor in any severity changes. This also means that the existing risk of epidemic levels of insects and disease remains constant over time. The risk of invasive and noxious plant establishment and spread as a result of management activities is least with alternative 3 and greatest with alternatives 1 and 4, due to the level of disturbance. None of these alternatives substantially increases resistance and/or resilience to climate change over current conditions.

Alternative 2

Alternative 2 trends this ERU toward desired conditions for all characteristics except fire severity and maintains ecological status and patch size within desired conditions. By virtue of allowing more mixed-severity prescribed fire, this characteristic moves away from desired conditions. However, this alternative reduces the proportion of closed-canopy conditions by 3 percent at the end of the first decade, and continues to move toward more open-canopy conditions in subsequent decades, moving toward desired conditions for seral state proportion and coarse woody debris, and reducing the risk of epidemic levels of insects and disease. However, with more acres experiencing wildfire, snag density increases, moving away from desired conditions. More disturbance on the landscape also increases the susceptibility to invasive and noxious species establishment and spread, but overall, this alternative does the most to promote resistance and resilience to climate change. However, there is also a risk of realignment as longer fire-free periods may be necessary for pine regeneration (Enright et al. 2015). More fire on the landscape, combined with regeneration failure could promote conversion to an evergreen oak shrubland.

Alternative 5

Alternative 5 does generate movement toward desired conditions for seral state proportion and maintains seral state proportion and patch size within desired conditions, but not to the degree that alternative 2 does. However, there is greater movement toward desired conditions for coarse woody debris and snag density, and twice as much area moves to open-canopy conditions by the end of the first decade. This represents a greater reduction in insects and disease risk. However, with more acres experiencing wildfire, this alternative results in greater susceptibility to invasive and noxious species establishment and spread. It also moves fire severity further away from desired conditions than alternative 2, but maintains frequency within desired conditions. The trade-offs that could be encountered as climate change progresses are similar to those discussed for alternative 2, but the risk of fire-facilitated realignment is greater.

Effects to Madrean Piñon-Oak Woodland

The Madrean Piñon-Oak Woodland is transitional between Ponderosa Pine-Evergreen Oak and the Semi-Desert Grassland, and intergrades with other woodland types. The central tendency of this ERU is dominated by open to closed canopy of evergreen oaks, alligator juniper, Mexican piñon, border piñon, Chihuahua pine, and other pines with a grassy understory. While the Madrean influence can be observed in the floristics of this ERU as it is mapped in the Gila NF, it is not strongly expressed. On the Gila NF, two-needle piñon is dominant, with Mexican and border piñon being subordinate, and only occasionally codominant. Chihuahua pine is uncommon, but does occur.

The most substantial difference between this ERU in the Gila NF and elsewhere, is the limited potential for a grassy understory. It occurs on shallow, weakly developed soils on rhyolite and tuff and has a substantial bedrock outcrop component. Soil temperature and moisture regimes support more of an evergreen shrub-dominated understory, rather than a grassy understory. This has implications for natural fire regimes, in terms of both frequency and severity.

Relatively little Madrean Piñon-Oak Woodland is mapped in the forest, representing approximately 1 percent of the forest's area. However, with current seral state proportions within desired conditions, the opportunity for the forest to function as refugia for some of this ERU's associated species does exist. At present, there is a 22 percent departure from desired conditions for seral state proportion. Ecological status is in moderate departure. Snag densities are estimated to be within desired conditions with an average one snag per acre. Coarse woody debris, however, is estimated to be an average of 16 tons per acre, as opposed to the average 3 tons per acres desired. This ERU has no objectives, and so little of it is located in the WUI that no prescribed fire or mechanical treatments were modeled. Wildfire is the factor driving differences between modeled outcomes. Figure 18 displays those results, which are discussed subsequently.

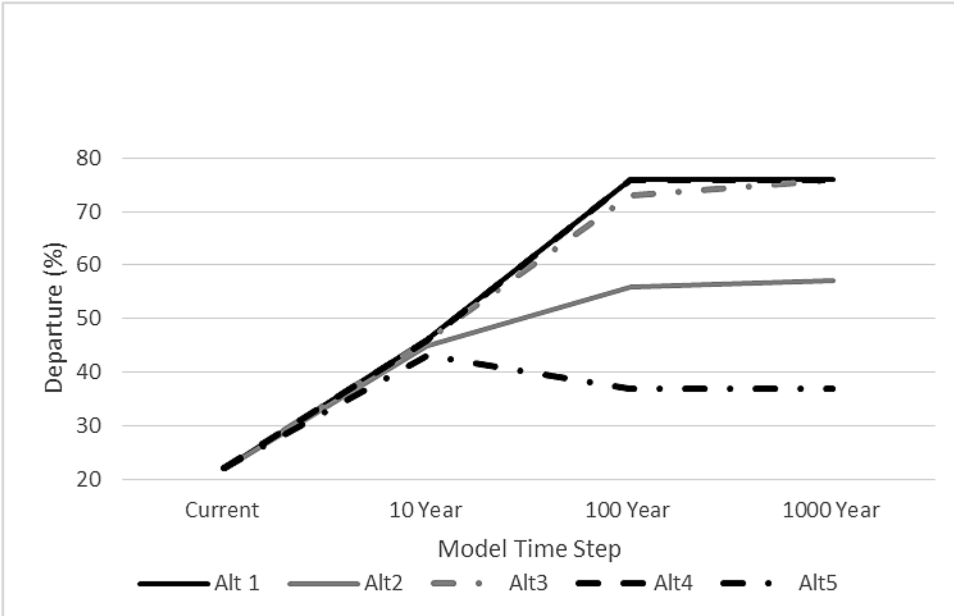

Figure 18. Madrean piñon-oak woodland seral state proportion departure from desired conditions

All Alternatives

Despite very different approaches to wildfire management and use between alternatives 1, 3, and 4 and alternatives 2 and 5, all move seral state proportions, ecological status and coarse woody debris away from desired conditions. Snag densities also move away from desired conditions under all alternatives except alternatives 2 and 5, which reduce snag densities and maintains that characteristic within desired conditions. Alternatives 2 and 5 also decrease the rate of movement away from desired conditions for seral state proportion and coarse woody debris after the first decade, but still retain the trend. The trend is related to an increase in early seral open-canopy conditions and late seral closed-canopy conditions, and a decline in closed canopy mid-development conditions.

Under alternatives 1, 3, and 4 regeneration infilling late seral open-canopy states and a general lack of disturbance moving area to early seral states is responsible for the trend. Under alternatives 2 and 5, wildfire is maintaining some late seral open-canopy conditions and recruiting area to early seral states, but not enough to maintain desired conditions for seral state proportion or coarse wood debris.

All alternatives see an overall, trend toward more closed-canopy conditions, resulting in an increase in the risk of epidemic levels of insect and disease of similar magnitude. The risk of invasive and noxious plant establishment and/or spread is least for alternatives 1, 3, and 4 and greatest under alternative 5, as more disturbance occurs under that alternative.

Despite the projections, there is a great deal of uncertainty as to how well the models represent this ERU in the Gila NF. As natural growth is represented by data across Arizona and New Mexico that Regional Office staff determined was representative of the region as a whole, and growth is limited by the soil type on which it occurs in the Gila.

Effects to PJ Woodland

This ERU represents persistent woodlands, where infrequent to very infrequent and high-severity disturbances are the norm. Development takes place in distinct stages, and typically represents even-aged dynamics. Closed-canopy conditions are not uncommon, nor undesirable. Understories are frequently sparse; however, Gila NF-specific data suggest that this ERU has some area on productive soils where this was not the case historically, and remains that way today. This may be an indicator that these areas were historically open-canopy, frequent fire ecosystems, rather than closed-canopy, infrequent fire systems. In other places, open-canopy conditions exist where rock outcrop, shallow soils and/or low soil productivity limit both woody and herbaceous vegetation densities, which still supports infrequent, high-severity disturbance regimes.

As mapped, PJ Woodland represents 26 percent of the forest and is the most common ERU. The Gila NF has a substantial opportunity to contribute to ecological integrity and sustainability. It is currently 36 percent departed from desired conditions for seral state proportion. Ecological status is in moderate departure. Patch size is also in moderate departure with mean patch size being smaller than desired. Coarse woody debris is estimated to average 18 tons per acre, as opposed to the desired average of 4 tons per acre. Snags are estimated to average two per acre, as opposed to the desired average of one. The relatively low level of departure for seral state proportion is due to more acres under open-canopy conditions than desired.

This ERU has no ecological objectives given that its low level of departure in seral state proportions is due to more open-canopy conditions and it is an infrequent disturbance ecosystem. However, under the 1986 forest plan, a majority of the woodland work has been done in what is mapped as PJ Woodland. Mechanical and prescribed fire treatment acres used in the models are presented in table 11. Wildfire acres are not included as this is better presented as a likelihood, or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 19 displays model results. This information is referenced in the subsequent discussion of effects.

Table 11. Acres treated per decade modeled for PJ Woodland under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	8,557	1,255	1,255	1,255	1,255
Prescribed Fire	37,042	0	0	0	0

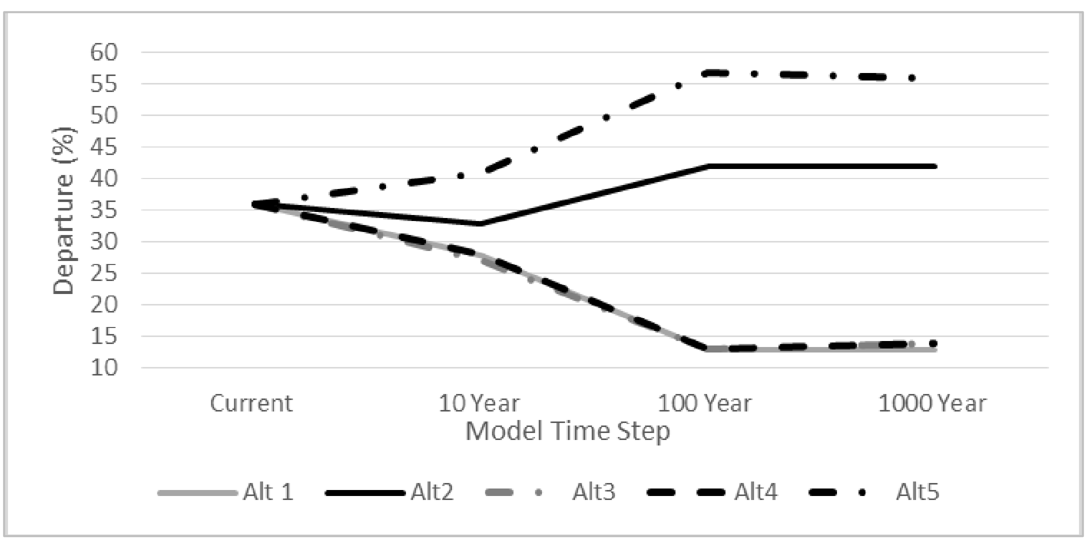

Figure 19. PJ Woodland seral state proportion departure from desired conditions

Alternatives 1, 3, and 4

Very little difference is observed between these alternatives despite the difference in treatment methods and number of acres treated. All of these alternatives trend seral state proportions, ecological status, and patch size toward desired conditions, because the number of acres treated mechanically is not substantial enough in terms of proportion of the ERU treated. Furthermore, under alternative 1, prescribed fire is doing very little to change conditions. In terms of coarse woody debris and snag densities, all three of these alternatives lead to trends away from desired conditions. This represents conditions that are primed and ready for an infrequent, high-severity fire to occur. While this may not be ecologically inappropriate, it is problematic for wildland fire management depending on how contiguous of an area could be affected. As conditions move toward desired conditions, the proportion of this ERU under closed-canopy conditions increases, as does the risk of epidemic levels of insects and disease. The risk of invasive and noxious weed species establishment and spread remains low under the model projections as a result of management, but may be inherently higher given that high-severity fire is typical of this system. These alternatives generally promote resistance and resilience, with the strongest support being provided by alternative 1, as increases in coarse woody debris are less than under alternatives 2 and 4.

Alternatives 2 and 5

Increased use of wildfire on the landscape in alternatives 2 and 5 leads to movement away from desired conditions for seral state proportion and snag density, but toward them for coarse woody debris. The trend away from desired conditions for seral state proportion is because more area is moving from closed-canopy conditions to open-canopy conditions, which could be a positive change in terms of reducing potential fire management problems and the risk of epidemic levels of insects and disease. But, this does not support ecological integrity, resistance, or resilience to the degree that the other alternatives do. The risk of invasive and noxious weed species establishment and spread is greatest over the short term, due to more disturbance, but lowest over the long term as the likelihood of extensive high-severity wildfire declines with declining canopy cover. Given movement away from desired conditions for seral state proportion, these alternatives promote realignment to future climate.

Effects to PJ Grass Woodland

PJ Grass Woodland is a historically open canopy, frequent fire ERU, with tree canopy cover ranging from 10 to 30 percent. Alligator and one-seed junipers, and two-needle piñon are the most common tree species. One or more species of evergreen oak may also be present, but are typically subordinate. As currently mapped, this woodland represents approximately 9 percent of the forest. With higher representation in the forest than in the surrounding landscape, forest management is an important contributor to ecological integrity and sustainability.

This ERU’s current seral state departure from desired conditions is estimated at 39percent, due to more closed-canopy conditions, and higher densities of seedling, sapling and small-sized trees. Ecological status is in moderate departure. Coarse woody debris is currently higher than desired conditions, with an estimated average of 21 tons per acre rather than an average of 4 tons per acre. Estimated snag densities are within desired conditions at an average of one per acre.

Mechanical and prescribed fire treatment acres used in the models are presented in table 12. Wildfire acres are not included as this is better presented as a likelihood, or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 20 displays model results. This information is referenced in the subsequent discussion of effects.

Table 12. Acres treated per decade modeled for PJ Grass Woodland under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	3,046	4,538	19,538	538	1,972
Prescribed Fire	5,350	2,500	500	0	24,000

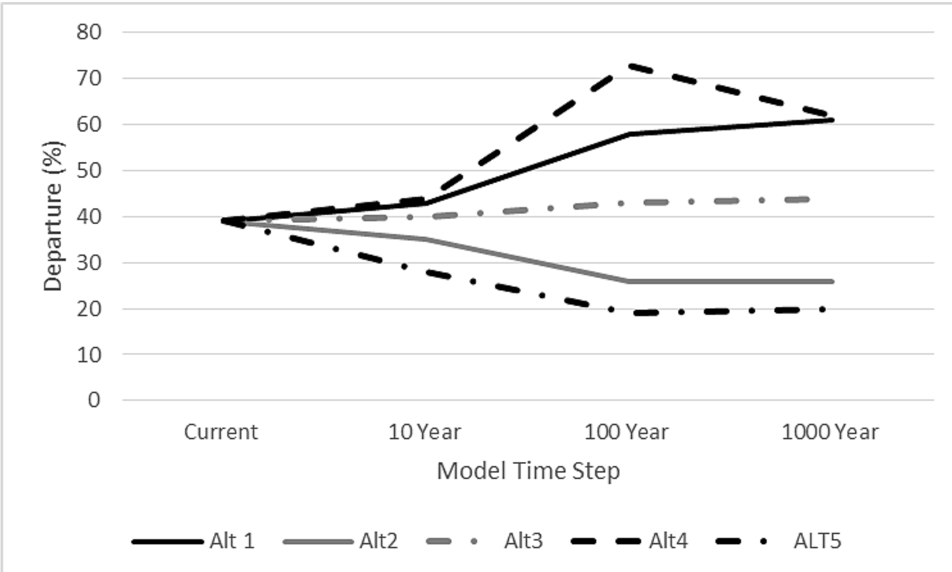

Figure 20. PJ Grass Woodland seral state proportion departure from desired conditions

Alternatives 1, 3, and 4

Despite differences in treatment methods and acres treated with each, these alternatives trend seral state proportions, ecological status, and coarse woody debris away from desired conditions, although this trend is far less substantial under alternative 3. None of these alternatives treat enough acres to keep pace with tree regeneration, re-sprout, and growth. All of these alternatives reduce snag densities somewhat, but still maintain them within desired conditions. Fire frequency continues to move away from desired conditions under these alternatives, and with more area being recruited to closed-canopy conditions over time, this could result in movement away from desired conditions for severity.

Likewise, the risk of epidemic levels of insects and disease is expected to increase over time as the amount of area under closed-canopy conditions increases. The risk of invasive and noxious species establishment and spread is greatest under alternative 3 and least under alternative 4, as a function of ground disturbance. None of these alternatives promote resistance or resilience to climate change, instead increasing the risk of wildfire-facilitated conversion to grassland or shrubland.

Alternatives 2 and 5

Alternatives 2 and 5 increase the use of wildfire, which is responsible for the trend toward desired conditions for seral state proportions, ecological status, coarse woody debris, and fire frequency. Seral state proportions are within desired conditions by the end of the first decade. Severity trends away from desired conditions for prescribed fire to function as a restoration tool. Alternative 2 uses wildfire such that 6 times more area is likely to experience fire than under alternatives 1, 3, and 4. That increase doubles under alternative 5, but there is only a 6 percent difference between alternatives 2 and 5 in terms of seral state proportion at the end of the 1,000-year time step. Both alternatives increase the prevalence of open-canopy conditions, reducing the risk of epidemic levels of insects and disease, and promoting resistance and resilience to climate change. The risk of invasive and noxious establishment and spread is greatest under both of these alternatives, but between them, alternative 5 represents the most risk due to more acres of disturbance.

Effects to Juniper Grass Woodland

Similar to PJ Grass Woodland, this ecosystem is a historically open canopy, frequent fire ERU, with tree canopy cover ranging from 10 to 30 percent. The difference is that this ERU generally occurs in warmer, drier settings, beyond the environmental limits of piñon. While there is less of this ERU in the forest (approximately 5 percent) than PJ Grass Woodland, and more in the surrounding landscape, management still has opportunities to contribute to ecological integrity and sustainability.

This ERU's current seral state departure is estimated at 29 percent, due to more closed-canopy conditions, and higher densities of seedling, sapling and small-sized trees. However, it is within desired conditions (less than 33 percent departure). Coarse woody debris is currently higher than desired conditions, with an estimated average of 10 tons per acre as opposed to an average of 3 tons per acre. Estimated snag densities are within desired condition at an average of one per acre.

Mechanical and prescribed fire treatment acres used in the models are presented in table 13. Wildfire acres are not included, as this is better presented as a likelihood, or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 21 displays model results. This information is referenced in the subsequent discussion of effects.

Table 13. Acres treated per decade modeled for juniper grass woodland under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	208	4,147	13,147	147	537
Prescribed Fire	109	2,500	500	0	18,000

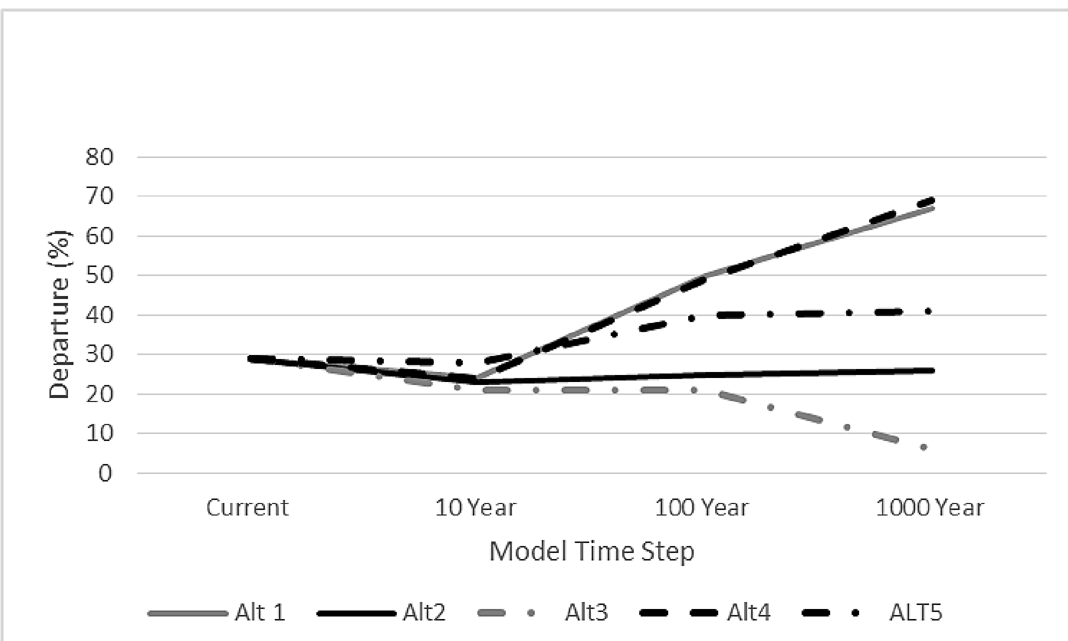

Figure 21. Juniper grass woodland seral state proportion departure from desired conditions

Alternatives 1, 4, and 5

These alternatives move Juniper Grass Woodland away from desired conditions in seral state proportion but for different reasons. Alternatives 1 and 4 do not treat enough acres, and more area moves into closed-canopy conditions over time. Alternative 5 allows for so much more fire, both prescribed and naturally ignited, that tree canopy cover is reduced below 10 percent over more area than is desired. While there is some uncertainty associated with the model, similar to that described for Ponderosa Pine Forest, alternative 5 moves 45 percent of the total ERU area into less than 10 percent tree canopy cover between the end of the first decade and the end of the 100-year model run. Alternatives 1 and 4 continue to move fire frequency away from desired conditions, and given the increase in closed-canopy conditions, presents a risk that fire severity could move away from desired conditions. Because the acres of fire under alternative 5 were calculated based on historic fire regimes, fire frequency moves toward desired conditions. By design, alternative 5 allows more mixed-severity fire prescribed fire, contributing to movement away from desired conditions.

Alternative 5 reduces the risk of epidemic levels of insects and disease over time, and increases the risk of invasive plant species establishment and spread. Alternatives 1 and 4 increase the risk of epidemic level of insects and disease and decrease the risk of invasive species establishment and spread. All of these alternatives promote realignment rather than resistance and resilience. Alternative 5 does so as a direct result of management action, while alternatives 1 and 4 do so by increasing the risk of wildfire-facilitated conversions to grassland or shrubland.

Alternative 2 and 3

While both of these alternatives maintain seral state proportions within desired conditions, alternative 3 demonstrates improvement. There is only a 6 percent departure from desired conditions at the end of alternative 3’s 1,000-year model run. Both alternatives also reduce snag densities, maintaining them within desired conditions. However, coarse woody debris and fire frequency trend toward desired conditions under alternative 2, and away from desired conditions under alternative 3. The trend away from coarse woody debris under alternative 3 is related to fewer acres treated overall, as the use of wildfire remains similar to alternative 1, leading to fewer acres treated as compared to alternative 2. Both alternatives maintain a low risk of epidemic levels of insects and disease, and both increase the risk of invasive and noxious species establishment and spread. However, alternative 2 increases the latter risk to a greater degree than alternative 3, because more acres are disturbed. Overall, alternative 2 does a better job of promoting resistance and resilience under future climate.

Effects to Mountain Mahogany Mixed Shrubland

Mountain Mahogany Mixed Shrubland typically occurs in the foothills, on canyon slopes and lower mountain slopes of the Rocky Mountains, and on outcrops and canyon slopes in the western Great Plains. It ranges from southern New Mexico and extends north into Colorado. These shrublands are often associated with exposed sites, rocky substrates, dry conditions, and recurrent but infrequent historic fire that limited tree growth. Scattered trees or inclusions of grassland patches may be present, but the vegetation is typically shrub-dominated.

The general description fits much of the Mountain Mahogany Mixed Shrubland mapped in the Gila NF, However oak-dominated areas, primarily in the Gila Wilderness have been mapped as such when they are more accurately described as early seral states in Mixed Conifer-Frequent Fire or Ponderosa Pine-Evergreen Oak. This is the result of previous stand-replacement fire. Additionally, this ERU is mapped in gentle sloping terrain in the Burro Mountains where oak species dominate. Mountain mahogany, desert buckbrush, catclaw, silktassel, sumac, and beargrass are typically subordinate. In this area, the existing vegetation is strongly influenced by historic overgrazing and granitic soils, and most likely represents a permanently altered grassland state.

Mountain Mahogany Mixed Shrubland is relatively common in the forest, representing 5 percent of its land area, but it is rare in the surrounding landscape, providing the opportunity for Gila NF management to contribute to ecological integrity and sustainability. It currently has a 63 percent departure from desired conditions in seral state proportion. Ecological status is moderately departed. Fire frequency is within desired conditions, but fire severity has been substantially lower than what is known about the historic fire regime. None of the alternatives has objectives for Mountain Mahogany Mixed Shrubland outside of the WUI. Wildfire management is the primary influence. Figure 22 displays modeling results, which are discussed subsequently.

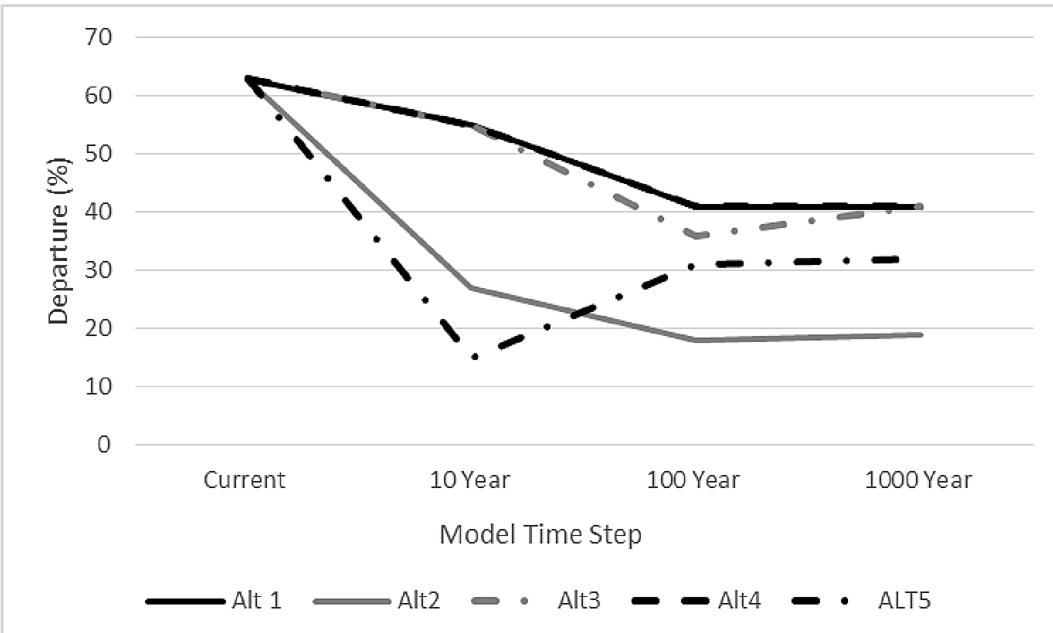

Figure 22. Mountain mahogany mixed shrubland seral state proportion departure from desired conditions

All Alternatives

All alternatives move seral state proportion and ecological status closer toward desired conditions, but only alternatives 2 and 5 achieve and maintain them because more acres experience wildfire under these alternatives. All maintain fire frequency within desired conditions, but only alternative 2 moves severity within desired conditions, as inferred by its ability to maintain desired conditions in seral state proportion. Alternative 5 increases severity, which moves it toward desired conditions initially, but exceeds it subsequently, as inferred from the divergence between alternatives 2 and 5 after the first decade. Epidemic levels of insects and disease are not a concern in this ERU. As seral state proportion moves toward desired conditions, the risk of invasive and noxious weed species establishment and spread increases, as change is driven by disturbance. All alternatives promote resistance and resilience to future climate, but alternative 2 provides the strongest support.

Effects to Montane/Subalpine Grasslands

Typically found above 8,000 feet, these grasslands often harbor, or have the potential to harbor several distinct plant associations with varying dominant herbaceous species. Such dominant species include Arizona fescue, mountain, screwleaf and/or Wright's muhlys, pine dropseed, a variety of sedges, bulrushes, wire rush, Rocky Mountain iris, and corn lily. Trees that may occur along the periphery of these grassland meadows include Engelmann or blue spruce, corkbark, Douglas and/or white fir. Meadows are typically seasonally wet, which is tied to snowmelt. Montane/Subalpine Grasslands are frequently associated with the Herbaceous Wetland Riparian ERU. Tree and shrub cover were historically less than 10 percent each.

Current departure from desired conditions for seral state proportion is 64 percent due to woody species encroachment and altered herbaceous species composition, which is reflected by a moderate departure in ecological status. Fire is not occurring quite as often as desired, but severities are likely consistent with historic or desired severities. Mechanical and prescribed fire treatment acres used in the models appear in table 14. Wildfire acres are not included as this is better presented as a likelihood, or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 23 displays model results. This information is referenced in the subsequent discussion of effects.

Table 14. Acres treated per decade modeled for montane/subalpine grasslands under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	5,381	4,768	11,000	168	61
Prescribed Fire	5,381	10,000	500	0	12,000

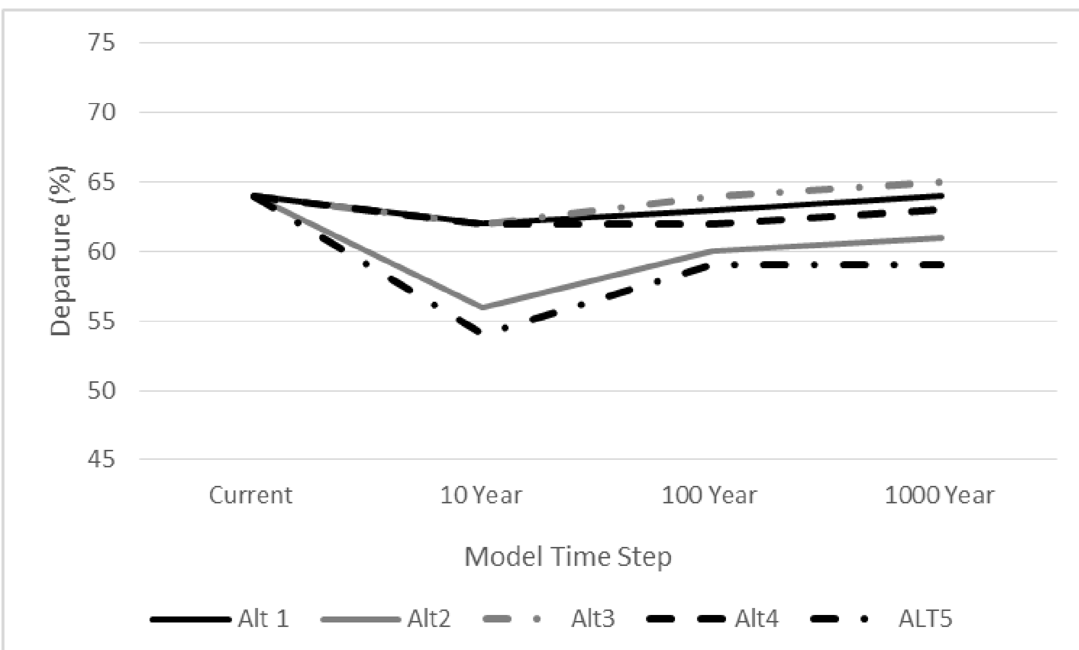

Figure 23. Montane/subalpine grasslands seral state proportion departure from desired conditions

All Alternatives

These alternatives show initial movement toward desired conditions, but the overall trend is to maintain existing departure in seral state proportion and ecological status. In part, this is simply due to not enough acres being treated to overcome tree encroachment, but also because the models cannot show movement toward desired herbaceous species composition. Any changes would be the result of changes in weather patterns, wildlife populations and patterns of use, and livestock grazing management, none of which are represented in the models. This is true of all alternatives. Alternatives 2 and 5 make slightly better progress toward desired conditions, treating sufficient acres with fire to reduce areas of encroachment. Alternatives 2 and 5 best promote resistance and resilience to future climate.

Alternative 1 maintains existing levels of departure in fire frequency, while alternatives 3 and 4 would move away from desired conditions. Although there are different ways to think about fire severity in grasslands[o], severity is likely maintained within desired conditions by alternatives 1, 3, and 4, but moves away from desired conditions under alternatives 2 and 5. Historically, frequent surface fires were sufficient to kill invading seedling and saplings. Higher severity fires are needed to get tree mortality in encroached areas where trees have moved beyond the seedling or sapling stage.

Epidemic levels of insects and disease are not a concern in this ERU. The risk of invasive and noxious weed species establishment and spread is lowest under alternative 4 because fewer acres are disturbed. It is greatest under alternative 5, with the most acres disturbed.

Effects to Colorado Plateau/Great Basin Grassland

This grassland is typically associated with woodland and/or forested ERUs where piñon pine is part of the potential natural vegetation community. Common grasses may include but are not limited to blue grama, squirrel-tail, Wright’s muhly, western wheatgrass, mountain muhly, Arizona fescue, pine dropseed, wolftail and threeawn species. Historically, this ERU may have had more than 10 percent shrub cover, but not more than 10 percent tree cover.

Current departure from desired conditions for seral state proportion is 65 percent due to woody species encroachment and altered herbaceous species composition, as reflected by a moderate departure in ecological status. Much of it is a sod-bound blue-grama monoculture. Fire is not occurring as often as desired, but severities are likely consistent with historic or desired severities. Mechanical and prescribed fire treatment acres used in the models appear in table 15. Wildfire acres are not included as this is better presented as a likelihood, or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 24 displays model results. This information is referenced in the subsequent discussion of effects.

Table 15. Acres treated per acre modeled for Colorado Plateau/Great Basin grassland under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	1,564	2,171	8,800	171	62
Prescribed Fire	1,564	2,000	500	0	10,000

[o] LANDFIRE defines grasslands as being high-severity ecosystems, as fire results in total consumption of the herbaceous canopy. MTBS defines severity in terms of change, and given post-fire herbaceous response in areas dominated by those species, fire severity is typically characterized as low.

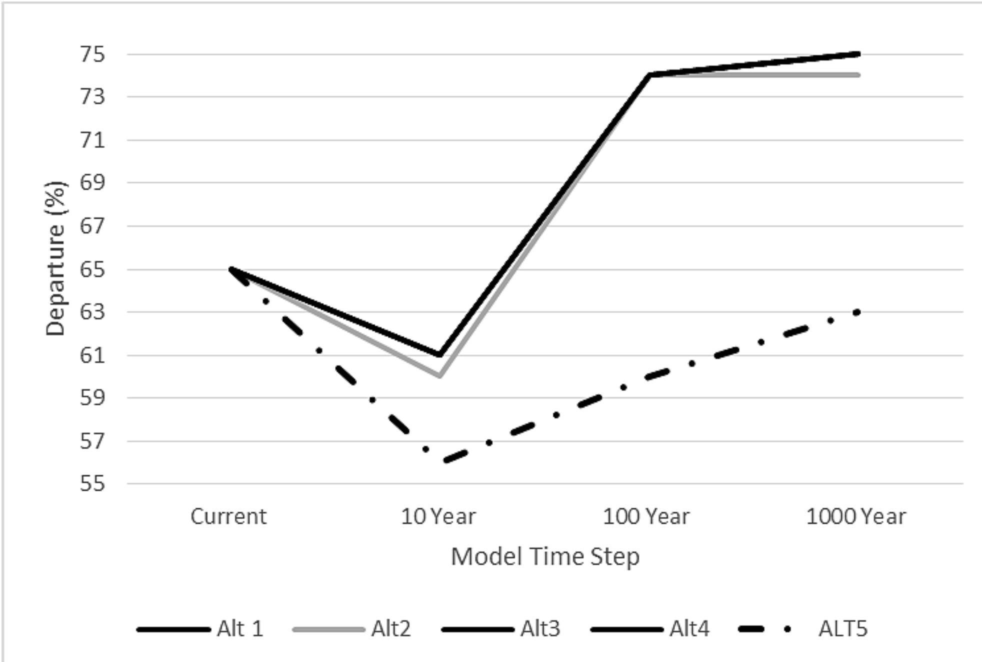

Figure 24. Colorado Plateau/Great Basin grassland seral state proportion departure from desired conditions

All Alternatives

Alternatives 1, 2, 3, and 4 trend seral state proportions and ecological status further away from desired conditions because they are not treating enough acres, and because the models are not capable of reflecting changes in herbaceous species composition, as previously described in the analysis of Montane/Subalpine Grasslands. Alternatives 2 and 5 move fire frequency toward desired conditions, but alternative 2 cannot keep pace with natural regeneration and re-sprout. Alternatives 3 and 4 move fire frequency further away from desired conditions compared to alternative 1.

Similar to the discussion of Montane/Subalpine Grasslands, alternatives 1, 3, and 4 maintain severity within desired conditions and alternatives 2 and 5 move it away from desired conditions. Alternative 5 provides for the most acres of treatment and the most severity, but still only allows for a miniscule trend toward desired conditions over time, given the ground gained within the first decade is lost in subsequent decades. However, it outperforms the other alternatives in terms of promoting resistance and resilience.

Epidemic levels of insects and disease are not a concern in this ERU. The risk of invasive and noxious weed species establishment and spread is lowest under alternative 4, with fewer acres disturbed. It is greatest under alternative 5, which has the most acres disturbed.

Effects to Semi-Desert Grassland

The Semi-Desert Grassland is the warmest and driest of the grassland ERUs in the forest and is typically associated with woodlands and the Mountain Mahogany Mixed Shrubland ERU. Historically, this ERU may have had more than 10 percent shrub cover, but not more than 10 percent tree cover. Sideoats, black, hairy, and blue grama grasses, wolftail, plains lovegrass, and a variety of threeawn and muhly species are common. Curly mesquite may be dominant in areas of heavier clay soils. While shrubs and sub-shrubs are clearly subordinate, they are common and sometimes abundant. The most diagnostic shrubs are sotol, beargrass, and yucca, although yerba de pasmo, Wrights beebrush, turbinella and/or gray oak, winterfat, and many other species may be present. The presence and abundance of acacia, mimosa, turpentine bush, and honey mesquite can be interpreted as indicators of drought and/or disruption in the natural disturbance regimes.

Current departure from desired conditions for seral state proportion is 94 percent due to woody species encroachment and altered herbaceous species composition, as reflected by a moderate departure in ecological status. Fire is not occurring as often as desired, but severities are likely consistent with historic or desired severities. Mechanical and prescribed fire treatment acres used in the models appear in table 16. Wildfire acres are not included as this is better presented as a likelihood, or probability, because these events cannot be planned in the sense that mechanical treatments and prescribed fire are planned. Figure 25 displays model results. This information is referenced in the subsequent discussion of effects.

Table 16. Acres treated per decade modeled for semi-desert grassland under each alternative

Treatment Activity	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Mechanical	1,372	923	6,000	122	45
Prescribed Fire	245	500	500	0	8,000

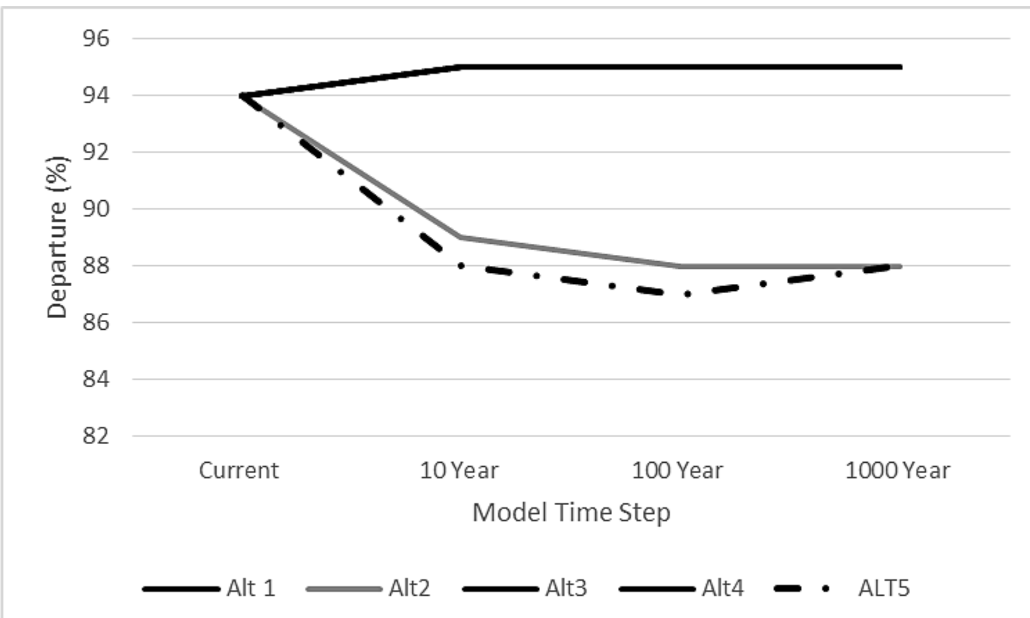

Figure 25. Semi-desert grassland seral state proportion departure from desired conditions

Alternatives 1, 3, and 4

These alternatives are likely to produce a slight trend away from desired conditions for seral state proportion and ecological status, simply because they do not treat enough acres. Fire frequency moves away from desired conditions under alternatives 3 and 4, as compared to alternative 1, which maintains existing departure. All maintain fire severity within desired conditions. The risk of invasive and noxious weed species establishment and spread is lowest under alternative 4, given that fewer acres are disturbed. It is greatest under alternative 3, with the most acres disturbed. Epidemic levels of insect and disease are not a concern in this ERU. None of these alternatives increases resistance and resilience.

Alternatives 2 and 5

These alternatives trend seral state proportions and ecological status toward desired conditions because the use of prescribed fire and wildfire allows more acres to be treated. Fire frequency moves toward desired conditions, but similar to the discussions of the other grasslands, fire severity increases, moving away from desired conditions. The risk of invasive and noxious weed species establishment and spread is higher than alternatives 1, 3, and 4, with alternative 5 representing the greatest risk. However, these alternatives increase resistance and resilience to future climate as opposed to the other alternatives.

Effects to Wildland-Urban Interface

All alternatives make progress toward desired conditions for the WUI, but none attains them. Even if treatments were effective for 20 years—which is unlikely to be the case where re-sprouting species such as alligator juniper and evergreen oak species are present—roughly 5 times more acres would need to be treated each decade than is fiscally achievable or proposed under any alternative. Where treatments occur and are maintained, firefighters will be able to engage in direct attack and risk to human values in the WUI will be reduced. Where treatments do not occur, or are not maintained frequently enough, firefighters will not be able to engage in direct attack and risk to human values in the WUI will either remain the same or increase, depending on site-specific circumstances. While additional partner investment could increase the rate and degree of progress being made toward desired conditions for the WUI, the forest does not typically compete well for additional funding because of the low population densities within and surrounding the forest.

However, alternatives 3 and 4 are least likely to generate progress toward desired conditions for the WUI, because the focus is on mechanical treatments and providing products to people. The WUI is not likely to provide the desired level of products, which means this focus leads to fewer acres of treatment in the WUI; fewer acres of treatments mean fewer opportunities for direct attack and greater risk to human values. In contrast, alternative 5 restricts mechanical treatments to the WUI, emphasizing fire management elsewhere. This provides the ability to treat more acres overall, and in the WUI. Alternative 5 provides the most opportunities for firefighters to engage in direct attack and the greatest reduction in risk to human values. Alternatives 1 and 2 are similar in their ability to move toward desired conditions, as alternative 2 will at a minimum, maintain the current emphasis on WUI treatments. This means these alternatives will at a minimum, maintain the current ability to engage in direct attack and the risk to human values will likely remain similar to what currently exists.

Effects Common to All Vegetation Types Resulting From Proposed Research Natural Areas

Although RNAs can be used to monitor climate change impacts (Massie et al. 2016), areas eligible for designation are in good condition, resulting from the predominance of natural processes. They do not need restoration treatments, although that would be allowable if needed to maintain the characteristics for which the areas were designated.

Alternatives 1, 2, and 5 carry forward the proposals for Turkey Creek and Rabbit Trap RNAs that were first brought forward during development of the 1986 forest plan. Alternative 1 also carries forward the proposals for Largo Mesa and Agua Fria RNAs, despite the fact that the updated evaluation found them ineligible for designation (see RNA process appendix H). Alternatives 3 and 4 propose no new RNAs. Despite these differences, there are no substantial ecological effects to any of the ERUs associated with any of the alternatives due to the small number of acres involved, with the exception of Rabbit Trap.

The proposed Rabbit Trap RNA has been excluded from livestock grazing since the 1940s. It was originally proposed during the last planning cycle as an example of recovery in a landscape that was historically overgrazed and will continue to experience grazing impacts. It also makes it an excellent candidate for monitoring climate change impacts and investigating relationships with land use. It may also serve as a refugial area for some species, such as Davidson's cliff carrot (see Wildlife and Botanical species).

RNAs are intended to provide opportunities for research. Research can expand the scientific understanding and basis for land management decisions, potentially contributing to better management. On this basis, alternatives 2 and 5 provide the greatest opportunities to advance scientific knowledge and improve management. Alternatives 3 and 4 provide no such opportunities. Alternative 1 provides opportunities, but by including proposals for two RNAs that don't qualify for that status, it may also detract from these opportunities.

Effects Common to All Vegetation Types Resulting From Recommended Wilderness Under All Action Alternatives

Under alternative 2, the recommended areas are generally coincident with IRAs and/or areas where terrain naturally constrains modes of access and mechanical treatments and road infrastructure is non-existent. The IRA status, in and of itself, does not preclude mechanical treatments, it just requires specific circumstances to be present and special permissions. On the Gila NF, IRAs were delineated in large part, based on terrain. Whether within or outside IRAs, steep and complex terrain increase the amount of engineering required and the cost of road infrastructure. Conventional ground-based harvesting equipment requires roads to enter an area and remove material. Conventional ground-based equipment cannot operate safely on slopes over 40 percent. Specialized equipment is necessary. These areas also do not currently have a predicted potential for large, contiguous patches of high-severity fire, even under extreme fire weather conditions (see Wilderness Process appendix F).

Under alternative 3, the same general conditions are descriptive of recommended areas predominated by grasslands and historically open-canopy woodlands. However, where forested/timberland vegetation communities dominate, terrain may not be limiting and the potential for large contiguous patches of high-severity fire may occur under extreme fire weather conditions. Conversely, under alternative 4, the conditions described for alternative 2 are descriptive of recommended areas dominated by forested/timberland vegetation communities, but those dominated by grasslands and/or historically open-canopy woodlands may also be in relatively gentle terrain and have the potential for large, contiguous patches of high-severity fire under extreme fire weather conditions. Under alternative 5, recommended areas include all of these conditions.

Table 17 displays the number of acres of each ERU that are recommended to Congress for wilderness designation by alternative.

Table 17. Upland ERU acres recommended to Congress for wilderness designation

ERU Name	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Spruce-Fir Forest	478	1,994	0	2,387
Mixed Conifer with Aspen	4,636	6,121	0	8,970
Mixed Conifer-Frequent Fire	40, 620	44,678	403	98,080
Ponderosa Pine Forest	10,419	17,719	557	111,308
Ponderosa Pine-Evergreen Oak	9,961	12,369	2,568	66,766
Madrean Piñon-Oak Woodland	782	272	1,674	10,278
PJ-Evergreen Shrub*	1,163	921	380	3,101
PJ Woodland	33,161	28,574	45,393	241,181
PJ Grass Woodland	1,410	2,524	4,327	74,972
Juniper Grass Woodland	0	11	7,464	35,943
Mountain Mahogany Mixed Shrubland	6,631	10,881	6,123	40,944
Montane/ Subalpine Grassland	0	456	183	13,711
Colorado Plateau-Great Basin Grassland	0	382	686	12,303
Semi-Desert Grassland	0	202	1,256	11,413
Total	**68,641**	**127,104**	**71,014**	**731,357**

* These acres have been reclassified and are now associated with the PJ Woodland ERU.

Plan direction for recommended wilderness areas precludes mechanical treatments as it does not conform to maintenance of wilderness characteristics. While this has the potential to impact management’s ability to move vegetation communities toward desired conditions, modeling results generally do not suggest a compelling need for mechanical treatments to move toward desired conditions for each ERU. However, the models are not spatial and the results do not describe the risk posed by spatially dependent processes such as fire. Where there are large, contiguous extents with relatively high probabilities of high-severity fire, strategic placement of mechanical treatments can enhance opportunities to manage fire on the landscape in such a way that the fire effects (identified previously) are mostly beneficial, vegetation conditions move toward desired conditions and adaptive capacity is restored (Krofcheck et al. 2018). Without mechanical treatments, the risk of detrimental effects, and movement away from desired conditions substantially increases.

Restrictions on mechanical treatments also have the potential to restrict future adaptation options. In particular, there is evidence to suggest that mechanical treatments could be necessary to maintain refugial areas (Krawchuck et al. 2016; Kolden et al. 2017). These are areas that might serve to conserve biodiversity during times of unfavorable environmental conditions. The Climate Change Vulnerability Assessment provides a coarse, first approximation of where refugia are likely to be located, but it is not appropriate for identifying fine-scale refugial areas that might exist (in sensu Ashcroft et al. 2009; Krawchuck et al. 2016; Kolden et al. 2017). Such an analysis has not yet been conducted for the Gila NF.

While any recommended area represents a potential future constraint on management’s ability to move toward and maintain desired conditions and/or maintain refugia, the areas recommended under alternatives 2, 3, and 4 are not realistically ever going to see mechanical treatments due to the substantial increase in associated costs. Alternative 5, however, recommends areas that could realistically be treated mechanically and have a need for treatment demonstrated by large contiguous areas susceptible to high-severity fire. While this alternative does provide for mechanical treatments outside of WUI, if and where strategic placement is demonstrated by scientific analysis, the amount of area recommended to Congress for wilderness designation substantially reduces those opportunities.

Cumulative Effects

Across the nation, Federal and State land management agencies continue to focus on two primary strategic objectives. These include (1) restoring degraded or declining ecosystems, and maintaining healthy ones in order to support multiple uses on a sustained yield basis, and (2) protecting communities and water supplies from wildfire and undesirable post-wildfire effects. The emphasis on reduction of wildfire risk to communities and water supplies is gaining momentum as the WUI expands and wildfire activity increases over what has been observed in the contemporary human experience. In response to recent large extents of high-severity fire across the western United States, collaborative groups including Federal and State agencies, local governments, non-governmental organizations and communities are making significant progress.

In Arizona and New Mexico, there is strong alignment between Federal and State strategic plans (EMNRD Forestry Division 2010; Arizona State Forestry Division 2010; NMDA 2014; USDA FS 2015a; USDA FS 2018b) and initiatives (USDA FS 2018c) and the opportunities for shared efforts are many. Common themes include using a science-based approach, collaboratively solving forest issues, engaging tribal governments and restoring and maintaining healthy, resilient, working landscapes. Together with their respective land departments, the New Mexico and Arizona State Forestry Divisions complete several thousand acres of fuel reduction treatments every year. Many of these treatments are developed in conjunction with private landowners and/or community wildfire protection plans. WUI treatments in the Gila NF and other national forests complement these activities.

The BLM provides wildland firefighting for resource protection, as well as using fire as a management tool to improve the health of the land. In managing livestock grazing on public rangelands, the overall objective of the BLM is to ensure the long-term health and productivity of rangelands and create the multiple environmental benefits that result from healthy watersheds. Treatment objectives in the revised forest plan are closely aligned. The Gila NF has recently partnered with the BLM to conduct prescribed fires, and the opportunities for future joint efforts are many. These activities increase the capacity of both agencies to restore fire to the landscape and move toward desired conditions for vegetation communities and the WUI.

The National Park Service (NPS) contributes to the ecological integrity and sustainability of native vegetation communities and promotes restoring the natural role of fire on the landscape. The Gila NF has accepted the delegation for fire management on the most proximate NPS lands, the Gila Cliff Dwellings National Monument. Other NPS lands are located at a distance sufficient to limit opportunities.

There is much more work that needs to be done than there are resources to accomplish it. Although there are opportunities for the Gila NF as previously described, resources have been and will likely remain focused near areas with higher population densities. Over the near term, many areas in the Gila NF, and other remote public lands that could benefit from treatment are likely to remain untreated. This could lead to undesirable extents of stand-replacement fire, particularly under extreme fire weather conditions.

What are now considered extreme fire weather conditions, are likely to become the norm under future climate. Fire seasons are also predicted to last longer. Some have projected that visitation to national forests will increase, with people taking trips to higher-elevation country seeking respite from the heat. This could lead to more human-caused wildfires. But these are not the only climate-driven changes that will effect vegetation communities. Climate change is also projected to amplify drought, and insect and disease activity. Drought alone is projected to lead to widespread regeneration failure in conifer species (McDowell et al. 2015 among others). Predicted increases in drought frequency, severity, and duration mean that many woody plants will require longer fire-free periods to produce enough seed to ensure species viability and that is not the most likely scenario (Enright et al. 2015). Compositional shifts in vegetation communities are predicted, and combined with amplified disturbance regimes, this could give non-native invasive or noxious species a competitive advantage. Vegetation productivity may decrease, but this could be partially offset by carbon dioxide fertilization.

The Climate Change Vulnerability Assessments conducted for national forests in Arizona and New Mexico suggests that high-elevation vegetation communities are at the greatest risk (Triepke 2017a). For example, Spruce-Fir Forest occupies a small percentage of the landscape and is at the southernmost extent of its range. Even a small rise in regional temperatures is likely to lead to type conversions. While fine-scale refugia could be dispersed across the region, it is more likely that the Santa Fe and the Carson National Forests will be the last remaining stronghold for high-elevation vegetation communities and their component species in the Southwest. At middle elevation, Mixed Conifer-Frequent Fire, Ponderosa Pine Forest and Ponderosa Pine-Evergreen Oak are also vulnerable such that the area they currently occupy is expected to shrink. Refugia are likely dispersed across the Southwest, but are likely to be more limited in the southeastern Arizona and southwestern New Mexico. Similar variability occurs for most woodland, shrubland, and grassland vegetation communities.

Unfortunately, more resources may be needed to address these issues and the resources available for public land management may become more limiting as the Nation struggles to meet a diverse range of challenges (USGCRP 2018).

Herbicide-Use Environmental Consequences

The following discussion of environmental consequences addresses the effects of the herbicide-use alternatives on upland vegetation communities, fire ecology and fuels, both within and outside the WUI.

Analysis Methodology

This is a qualitative analysis. No modeling has been done to support the findings, as herbicide transition pathways in the state-and-transition models have not been developed.

Effects Common to All Herbicide-Use Alternatives

All of the alternatives authorize the use of some herbicides on some number of noxious weeds. Existing infestations vary in size and extent; some infestations occupy small areas of less than an acre, while others are larger. In total, known infestations occupy less than 1 percent of the Gila NF. While the species and populations currently known to exist are not substantially reducing the productivity of the land at this time, this could change in the future. Noxious weeds reduce native plant diversity and can alter ecological processes through a variety of mechanisms. Some noxious species release toxins that suppress the growth of native plants or alter nutrient cycling. Others alter fire behavior, intensity, extent, and season of burning (Brooks et al. 2004), potentially leading to accelerated erosion and sedimentation. These strategies lead to long-term alteration of native plant community composition, reduced ecosystem function and movement away from the desired conditions for vegetation communities common to all forest plan alternatives.

Without herbicide, control, containment, and eradication of most noxious weed species would not be possible. Noxious weeds that complete their life cycle in one growing season often produce large quantities of small, wind-borne seeds that are capable of ensuring that the existing population persists into subsequent growing seasons, as well as establishing new populations. And, not all of them require ground disturbance to gain the competitive advantage over native plants. Perennial and biennial noxious weeds such as Canada thistle, also produce large quantities of small wind-borne seeds, but are also able to reproduce from root fragments. This ability, combined with large extensive lateral root systems, renders physical removal ineffective. With herbicide, control, containment, and eradication are possible. Where noxious species are eradicated, native plant communities and natural processes can be restored, increasing resilience and movement toward the desired conditions for vegetation communities.

However, the use of herbicides is not without risk. Herbicides are designed to kill plants by inhibiting plant enzymes, hormones, and pigments that regulate metabolic function. Some effects to non-target native plants is likely, even when all laws, regulations, policies, and plan direction are followed. Direct effects include mortality to individuals, reduced or prevented reproduction, and abnormal growth patterns.

The potential for herbicides to harm non-target native plants depends on the potency, selectivity, and persistence of the herbicide (see appendix K). Herbicides may reach non-target plants through the air, as drift or wind erosion, or through water or soil. Project design criteria use the risk assessments and include a requirement for pesticide-use plans that include measures to prevent spills and mitigate the effects if they occur. None of the alternatives include aerial applications, which minimizes drift. For backpack and boom-mounted sprayers, application at very low wind speeds and large droplet size generally help minimize drift. Cut-stump and pelletized application methods do not result in any potential for drift. In most cases, only the native plants immediately adjacent the targeted noxious species would be impacted and no harmful effects to the plant community as a whole would be expected. The benefits of removing the noxious species exceeds the cons of the potential damage to individual native plants. Over the long term, native plant communities would increase in health, diversity, and resilience, moving toward desired conditions.

Herbicides that remain in the soil for longer periods of time have the potential to cause the non-target or off-site effects or both, as do herbicides that are transported to water bodies. The potential for this is minimized by herbicide selection, adherence to label instructions, design criteria, and other site-specific considerations that may lower the hazard quotient. When a soil-persistent herbicide is necessary, rotating its use with other herbicides that are not persistent or waiting longer between applications can minimize the potential for non-target effects. Herbicides may travel to water bodies through overland flow or through flow from the soil. Typically, this is minimized by appropriate herbicide selection, adherence to label instructions, proper timing of application, and the use of buffers, when necessary. When there is potential for non-target, off-site effects to water bodies, those herbicides registered for use for aquatics must be used as a matter of law, regulation, and policy. This is discussed further in the soil and watershed resources and riparian and aquatic ecosystems sections.

Effects of Herbicide-Use, Alternative A (No Action)

Alternative A allows all noxious weed species on the New Mexico Department of Agriculture's noxious weed list as it existed in 2000, with the addition of tree of heaven, to be manually pulled or cut with a chainsaw and/or treated with herbicide. Fourteen different herbicides are approved for use, and all methods except aerial application are allowable. No new noxious weeds added by NMDA to the noxious weed list after 2000 are authorized for treatment and no native plant species may be targeted.

However, it does not fully support EDRR or the maintenance of vegetation communities dominated by native species. When new noxious species designated by NMDA are introduced and/or discovered, time is usually of the essence. The longer noxious weed populations are allowed to persist on the landscape, the greater the risk of spread and the more area that may need treatment. If discovered and treated early, eradication is more likely. If delayed, control or containment may be the only realistic goals, depending on the particular noxious species. This alternative does not facilitate rapid response to emerging threats and compromises management's ability to maintain, move toward, and achieve desired conditions for vegetation.

Effects of Herbicide-Use, Alternative B (Proposed Action)

Alternative B would also authorize the use of herbicide to control the density of native alligator juniper and evergreen oak species to accelerate progress toward desired conditions for vegetation communities and the WUI. Alligator juniper and evergreen oak species proliferate by seed and by re-sprouting. Hazardous fuels and restoration treatments open up the forest canopy and create warmer, drier site conditions that favor re-sprouting species and provide the physical space, light, and nutrients to stimulate germination and growth from the seedbank. Over the long term, these treatments lead to increased abundance and cover of alligator juniper and evergreen oak, potentially signaling initiation of a vegetation type conversion. While this doesn't happen everywhere or all the time, it does happen frequently. Furthermore, ladder fuels and fuel connectivity are increased, leading to potential increases in fire severity and size. Frequent maintenance is required, and even with that maintenance, the trajectory remains away from desired conditions for vegetation communities and/or the WUI.

When used in conjunction with mechanical treatments, herbicide may provide management the initial opportunity to change this trajectory, and on more acres, with fire typically being used to maintain, and ultimately achieve desired conditions under draft forest plan alternatives 1 and 2. Some exceptions could occur in WUI situations where prescribed fire is not a socially acceptable option. Fire, as a maintenance tool, would minimize the potential for the non-target effects discussed previously. Under draft forest plan alternatives 3 and 4, the decreased use of prescribed fire would necessitate herbicide be used more often, which would increase the potential for the non-target effects. Draft forest plan alternative 5 would use herbicide the least, as far fewer mechanical treatments are planned, providing the least opportunity for non-target effects.

Under any forest plan scenario, the potential for non-target effects is greatest for alternative B, as herbicide could see much wider use across the forest than herbicide-use alternatives that restrict use to noxious plant species.

Effects of Herbicide-Use, Alternative C

The effects specific to alternative C would be similar to the proposed action without treatment for woody native oak and alligator juniper. This alternative includes using the current noxious weed lists, EDRR, and EPA and Forest Service risk assessments. This would quickly address any new noxious species infestations or new herbicides that have undergone risk assessments.

Effects of Herbicide-Use, Alternative D

The effects specific to alternative D are similar to those specific to alternative B. However, herbicide use would only be restricted to the WUI, reducing the potential for non-target effects substantially as compared to alternative B. Outside the WUI, trajectories would remain unchanged for vegetation communities where alligator juniper and evergreen oak are present.

Cumulative Effects

Humans have introduced noxious plant species, and their introduction, establishment, and spread is likely to continue on Federal public lands, state and municipal lands, and private lands across the Southwest. Noxious plant propagules are moved to new areas by wind, water, people, vehicles, equipment, and animals. While not all noxious species require ground disturbance to establish, ground-disturbing activities do provide a better opportunity for establishment. While not the specific intent, reductions in open road density resulting from the congressionally legislated Travel Management Rule, may lead to a small reduction in exposure to noxious plant introduction on Federal public lands. Ground-disturbing activities on all lands will continue, and are likely to increase on Federal public lands and State lands, as the pace and scale of restoration activities increases, whether accomplished by mechanical treatments or fire. The increased susceptibility to invasion associated with these activities is expected to be short-term. Large extents of high-severity wildfire are also projected to increase, which could facilitate noxious plant species establishment and spread.

Federal and State management agencies recognize the harm noxious species pose and will continue to use all reasonable and economically feasible tools at their disposal to combat the problem. Municipal and private lands continue to be a source of noxious plant propagules, as not all individuals recognize the environmental and economic harm they pose. Conservation and collaborative education programs have and will continue to raise awareness, which supports prevention and early detection rapid response. Plant-savvy public land users and volunteers increase the ability of the Gila NF, and other national forests, BLM field offices, and State agencies to detect, monitor, and even treat noxious plant populations.

Herbicides will continue to be used on all jurisdictions as a way to effectively treat noxious plants. Herbicide will also continue to be used as a restoration tool. In the Southwest, it is becoming a common and successful practice on State, private and BLM lands, but it has seen fairly limited use on National Forest System lands because of public concerns and a general lack of social license. While a segment of the public advocates for herbicide as a restoration tool, there is also a segment that advocates against it.

The use of herbicides, when added to all the reasonably foreseeable activities and associated effects that could occur under the draft forest plan alternative ultimately selected, and those described under the plan-level cumulative effects analysis, have a greater potential for positive outcomes for vegetation communities than negative ones. This is associated with limiting the spread of noxious plants, and with the ability to treat more acres mechanically because maintenance needs are reduced.

However, both its persistence in the environment and efficacy as a treatment tool may change with climate.

Evidence suggests that rising soil temperatures will result in quicker herbicide degradation (Baily 2004). This means the likelihood of herbicide moving through the soil to non-target plants or water sources will decrease, as will the length of time it effectively kills the target plant species. Beyond the rate of herbicide degradation, climate change is likely to alter the effects to target plant species as moisture and temperature patterns before, during, and after application have a significant influence on efficacy (Varanasi et al. 2016). These changes are likely to be highly specific to the particular plant species and the chemistry of the herbicide. Climate change could lead to more herbicide resistant noxious weeds and result in permanent changes to the native vegetation communities they invade.

More extreme weather events may also alter the movement of herbicides in the environment. Longer, hotter droughts punctuated by extreme precipitation events could lead to more runoff transport of herbicide, potentially leading to more off-site and non-target effects, depending on application timing relative to these storms.

Climate and Carbon

Affected Environment

Climate, or the average weather, is the primary system driver. It largely determines the timing, quantity, duration, and distribution of available water, and influences all ecological characteristics and processes including, but not limited to: rates of soil formation and loss, fire regimes, patterns of insect infestations and disease outbreaks and the distribution and abundance of plant and animal species.

Although regional climatic regimes persist for centuries, they do change and vegetation responds on a similar scale (Delcourt and Delcourt 1983). While climate has always undergone change over time, a sizeable body of science suggests the extent, magnitude, and rate of change we are currently undergoing may prove to be unprecedented in the context of the last two million years (Safford et al. 2012). In the southwestern United States, climate modelers agree there is a drying trend that will continue well in the latter part the century (IPCC 2007; Seager et al. 2007). While some models have predicted an increase in precipitation (IPCC 2007), rising temperatures are the primary concern, as they are expected to increase evaporation such that an overall decrease in available moisture remains likely.

Evidence of predicted warming trends is demonstrated in the New Mexico Southwestern Mountains and Southern Desert climate divisions where the data reveal average annual temperatures in the area have not dropped below the period of record average since the mid-1990s (USDA FS Gila NF 2017). Additionally, streamflow data demonstrate average flow has decreased in the winter and spring months (December through May), peak snowmelt runoff is occurring earlier, and the snowmelt runoff period is shortening (USDA FS Gila NF 2017). Furthermore, there is a declining trend in the median and/or average annual streamflow for some Gila NF streams (England 2002; Triepke 2013; USDA FS Gila NF 2017). These changes are consistent with climate predictions for the southwestern United States.

Climate change is not just a predicted future event. It is happening now. While the state of the knowledge needed to address climate change at a broad scale is still evolving, there is sufficient information to inform national forest management. Fortunately, many of the things that managers can do in the face of change and uncertainty, are supported by science under any climate scenario. This includes mitigation measures.

The science suggests that forests and woodlands on both public and private lands could play a substantial role in the sequestration of carbon and climate change mitigation (USDA FS Gila NF 2017; among others). Carbon is stored primarily as soil organic carbon or vegetative biomass carbon. It has been estimated that the Gila NF is currently sequestering approximately 211 million tons of carbon as above-ground vegetative biomass and soil organic carbon (USDA FS Gila NF 2017). Carbon carrying capacity is a term acknowledging that the amount of carbon that can be stored in an ecosystem has limits. It depends primarily on vegetation community characteristics under predominant climatic and natural disturbance regimes (Keith et al. 2009; Keith et al. 2010; among others), and on soil properties.

Carbon enters and exits the biomass and soil organic carbon pools through fluxes. The primary fluxes influenced by management on Federal public lands, including the Gila NF, include herbivory by permitted livestock and wildlife, fire management, and mechanical vegetation treatments. The balance between biomass carbon storage and fluxes is vital to maintaining Federal public lands as a net carbon sink, as the ability of vegetation to sequester carbon as biomass eventually becomes a wildfire liability (Hurteau et al. 2008; Hurteau et al. 2016; Hurteau 2017; Liang et al. 2017). Today's carbon sink can become tomorrow's carbon source; retaining the maximum amount of carbon that a site can biologically produce is not sustainable over the long term. Smoke contains many greenhouse gases, including carbon dioxide (National Research Council 2004). To date, there has been no binding commitment by the Federal Government or Forest Service for the regulation of carbon dioxide and other greenhouse gases emitted from naturally ignited or prescribed wildland fire.

Smoke also contributes to so-called "global brightening and dimming effects." Similar to climate change, brightening and dimming effects are a natural phenomenon influenced by human activities. These effects are tied to atmospheric concentrations of aerosols, which are basically very fine particulate matter in the air. Higher concentrations of aerosols absorb more of the sun's heat energy, "dimming" the effect of that heat energy and keeping temperatures cooler. Lower concentrations of aerosols have a "brightening" effect, allowing more the sun's heat energy to reach the Earth's surface, contributing to warmer temperatures. Aerosol levels in the atmosphere naturally fluctuate with events like wildfire, volcanic eruptions, and dust storms.

Prior to implementation of the Clean Air Act and similar regulations elsewhere in the world, human-elevated levels of aerosols enhanced the dimming effect and reduced observed rates of climate change. Better air quality as a result of actions taken under air quality regulations have reduced aerosol concentrations, activated the brightening effect in some locations around the globe, and some speculate that it is accelerating the rate of observed climate change. However, the role of the brightening and dimming effect on climate change remains secondary to the role of greenhouse gases (Wild 2009). While wildland fire has been and is expected to remain the primary source of greenhouse gas and fine particulate matter emissions generated in the Gila NF, other activities also contribute.

Activities dependent on the combustion of fossil fuels, specifically Forest Service operations, motorized uses including forest access, mechanical vegetation treatments, and mining generate greenhouse gases. Methane, a greenhouse gas, is also released by the digestive processes of most grazing animals. Grazing animals with two stomach compartments, like cattle, produce substantially more methane than those with a single stomach compartment such as elk, deer, or horses. Most of the emissions generated by grazing animals comes from cultivated pastureland and feed lots. No research has been conducted to quantify what proportion of emissions might be attributed to livestock grazing on public lands, although it is very likely to be negligible. Additionally, any activity that generates dust, generates particulate matter that can contribute to aerosol formation; the extent of bare soil and moisture conditions are the primary factors influencing the amount of dust generated by activities in the forest.

Plan-Level Environmental Consequences

The following discussion of environmental consequences addresses the effects of the alternatives on climate and carbon. The effects of plan content on climate impacts on natural resources and resources uses are discussed in those sections of this chapter.

Analysis Methodology

Carbon Storage and Emissions

Carbon stored as above-ground vegetative biomass is analyzed quantitatively using coefficients that correspond to the various states that a particular vegetation community can express. For grasslands and shrublands, these coefficients were developed based on information gleaned from the scientific literature and web resources (Scott and Burgan 2005; USDA FS 2012a). For woodlands and forest/timber type vegetation communities, the coefficients were developed based on (FIA data, collected across Arizona and New Mexico and the carbon sub-model of the Forest Vegetation Simulator-Fire and Fuels Extension (Weisz et al. 2010). These coefficients are available in the project record.

The average per acre biomass carbon stored in a given vegetation type is calculated based on the current and modeled future distribution of vegetative states and compared to desired conditions in terms of percent departure. Desired conditions for biomass carbon are derived from the desired conditions for the distribution of vegetative states specific to each vegetation type. In this analysis, those desired conditions are considered to be synonymous with carbon carrying capacity. As this analysis relies heavily on the state-and-transition modeling done for vegetation, it carries with it all of associated assumptions (see upland vegetation, fire ecology and fuels analysis methodology).

The results are summarized and discussed for grassland, shrubland, woodland, warm-dry forest/timber types and cold-wet forest/timber types on an area-weighted basis. Alternatives are compared to one another based on whether they are trending conditions toward or away from desired conditions. Similar to the approach taken in the assessment with departure from reference conditions, if departure is 33 percent of or less, it is within desired conditions. As the models are only capable of reflecting woody vegetation dynamics, trends in understory biomass is not represented here (see upland vegetation, fire ecology and fuels analysis methodology). This is addressed qualitatively. Soil organic carbon is also analyzed qualitatively, as it is not a model output. The scientific literature is used to support qualitative analyses.

Emissions associated with mechanical treatments and fire management activities are also analyzed quantitatively based on the smoke emissions modeling that supports the air quality analysis, and therefore carries with it all of the associated assumptions (see air quality analysis methodology). Greenhouse gases included in these model projections include carbon dioxide, carbon monoxide, methane, and non-methane hydrocarbons. Particulate matter is also a model output but is not analyzed here as brightening and dimming effects are a secondary driver of global change (Wild 2009). Inferences are also drawn from the state-and-transition modeling. Emissions generated by Forest Service operations motorized uses including forest access, energy and mineral development, permitted livestock grazing, and dust generation are analyzed qualitatively.

Area Designations

Area designations can influence how the forest manages for ecosystem characteristics, including carbon. Designations that substantially change the allowable types of activities, equipment, and/or modes of access and travel have the potential to influence the extent and distribution of effects and at times, the outcomes of management activities. Area designations with this potential include designated wilderness, recommended wilderness, designated and proposed RNAs, IRAs and other administrative designations. The effects depend on the designation, amount of area involved, vegetation types and conditions that exist within that area, and the terrain. Terrain can limit the types of activities, equipment and/or modes of access and travel just as effectively as a designation. The effects of proposals or recommendations for new area designations contained within each alternative are discussed qualitatively relative to these management factors and evaluated based on whether they are consistent with opportunities to move toward desired conditions for carbon or whether they detract. Existing designated wilderness, RNAs and IRAs are not discussed, as they do not contribute to differences in effects among alternatives. Special botanical areas proposed under alternatives 2 and 5 are not analyzed, as the plan direction for their management does not substantially change the types of activities, disturbances, or associated effects at the ecosystem level.

Climate Change Impacts

Climate change may impact the ability of the Gila NF to manage toward desired conditions for carbon and affect greenhouse gas emissions generated from activities in the forest. These are considered cumulative effects.

Effects Common to All Alternatives

Although the no-action alternative does not contain provisions for sustainable Forest Service operations as the proposed action and the other alternatives do, it is an agency-wide initiative. As such, sustainable operations would be implemented under all alternatives, regardless of plan content. Sustainable operations include measures Gila NF staff take to increase energy efficiency, reduce energy consumption and other practices that reduce greenhouse gas emissions associated with the daily business of managing the forest.

Greenhouse gas emissions generated by forest users are primarily transportation-related. Existing or proposed designations that limit the area where motorized travel is allowed are not expected to have an effect on associated emissions. Motorized use will not decline, but only become more concentrated in the areas where it is allowed. Increased visitation (see recreation section) and an aging population more dependent on motorized access could lead to increased emissions associated with motorized access.

Energy and mineral development can also be a source of greenhouse gas emissions, but these activities driven primarily by law, regulation, and market forces rather than plan direction. Given the forest's mineral resources (USDA FS Gila NF 2017), remote location, and market trends, no substantial amount of greenhouse gas emissions is expected as a result of foreseeable energy and mineral development, regardless of the alternative ultimately selected.

Greenhouse gas emissions associated with grazing animals are primarily generated by cattle, which ultimately depends more on market forces and project-level, allotment specific decisions rather than any plan-level alternative. Relatively small, temporary fluctuations could be associated with allotment-specific decisions, such as temporary non-use for permittee convenience, or reduced stocking levels as a drought adaptation. However, these emissions are expected to remain negligible and relatively stable as permitted livestock grazing continues under all alternatives.

Herbivory by permitted livestock also removes biomass carbon (Erb et al. 2018), and many have speculated that this translates to a reduction in soil organic carbon. Some studies support this speculation (Schulz et al. 2016; Deng et al. 2017); however, some studies suggest that proper grazing management increases soil organic carbon over no grazing (Reeder and Schuman 2002; Schuman et al. 2002), and/or that grazing intensity and stocking rates may be determining factors (Conant and Paustian 2002; Liu et al. 2012). As all alternatives contain direction requiring the livestock grazing be compatible with movement toward desired conditions for vegetation and soil, no declines in soil organic carbon are expected and increases are possible.

All alternatives have objectives for vegetation communities that include some combination of mechanical treatments and fire. As a result, all alternatives will have an initial carbon cost. Mechanical equipment runs on fossil fuels, which emit greenhouse gases to the atmosphere. Much of the biomass removed as a result of mechanical treatments will leave the forest as wood products.

Given their low value, most of those wood products are fuelwood, or go to make pallets. Burning of fuelwood results in greenhouse gas emissions. Pallets and other products that are not burned immediately continue to provide carbon storage off-forest for the life of their use. The removal of this material also reduces the amount of biomass available to burn when mechanical treatments are followed by prescribed fire or wildfire, which can substantially reduce greenhouse gas emissions associated with those events (Hurteau et al. 2008 among others).

Fire-caused greenhouse gas emissions will continue under all alternatives, but will vary in frequency, magnitude, and duration, depending on a variety of factors. These factors include vegetation types and conditions targeted for treatment, preferred treatment tools and/or combinations of tools, and the number of acres proposed to be treated. Proposals for designations that limit treatment tools and extents also contributes to differences among alternatives in some cases. However, wildfire remains the dominant driver of emissions under all alternatives, representing between 87 and 98 percent of the total greenhouse gas emissions. In the Southwest, carbon emissions generated by fire can exceed fossil fuel emissions at regional scales (Wiedinmyer and Neff 2007 as cited in USDA FS Gila NF 2017). In their study of fire emissions, Wiedinmyer and Neff (2007, as cited in USDA FS Gila NF 2017) found that on average, 4 to 6 percent of the total human-caused emissions in the United States arise from wildland fire. However, in a separate study, Woodbury and others (2007, as cited in USDA FS Gila NF 2017) estimated that 10 percent of the total human-caused emissions in the United States are captured by forest vegetation, which suggests that forests can sequester more carbon than they emit, and may become an offsetting solution.

Treatments in vegetation types that historically supported frequent surface fires will reduce the carbon stocks held in the forest, and result in greenhouse gas emissions over the short term. Over the long term, research demonstrates these treatments increase the likelihood of maintaining a net carbon sink into the future (Finkral and Evans 2008; Hurteau et al. 2016; Hurteau 2017; Hurteau et al. 2018). Post-treatment, biomass carbon stocks can recover quickly if the large fire-resistant trees remain (Hurteau and North 2010), which is easier to ensure with mechanical treatments, as fire is not a precise tool. However, mechanical treatments can increase nitrous oxide and methane emissions from the soil in some cases (Cambi et al. 2015).

Fire's influence on soil organic carbon stocks depends on severities and their extents. While mixed- and high-severity fire have been shown to result in the greatest soil organic carbon losses, low-severity fire has recently been demonstrated to lead to the loss of soil organic carbon as well (Jian et al. 2018). Low-severity fire leads to abrupt volatilization of water held in the pores of soil aggregates. The resulting changes in pressure expose organic carbon that had been protected in the aggregate structure, decomposition processes are initiated, and emissions from the soil increase (Jian et al. 2018). Fire also creates what is known as pyrogenic carbon, which includes soot, charcoal, biochar, and black carbon.

The physical and chemical characteristics of pyrogenic carbon depend on many variables, such as vegetative species it was formed from and the characteristics of the fire that created it. Initially, carbon in this form was thought to be highly stable over time periods as long as centuries. However, recent studies indicate that this is only true for some types of pyrogenic carbon. A part of the carbon stored in pyrogenic forms is highly water soluble and degradable, and as a result, has a shorter residence time in the terrestrial carbon pools than the vegetative biomass from which it was formed (Santin et al. 2016). Both stable and unstable pyrogenic carbon will accumulate under each of the alternatives, but it isn't possible to predict which will predominate.

Finally, dust will continue to be generated as a result of all the activities identified in this section. Dust generated by livestock is negligible and is expected to remain so or decrease as vegetation moves toward desired conditions. Dust generated by motorized travel across the forest, could increase with projected increases in visitation (see recreation section). Dust originating from patches of mixed- and high-severity fire are possible under all alternatives, with the significance depending on a variety of incident- and site-specific circumstances that make differentiating differences between alternatives highly speculative.

Effects Common to Alternatives 1, 3, and 4

Table 18 displays the greenhouse gas emissions projected to be generated as a result of these alternatives.

Table 18. Greenhouse gas emissions (expressed in millions of tons) generated as a result of prescribed and naturally ignited wildfire under alternatives 1, 3, and 4

Greenhouse Gas	Alternative 1	Alternative 3	Alternative 4
Methane	0.02	0.02	0.02
Carbon Monoxide	0.46	0.40	0.41
Carbon Dioxide	9.99	8.63	8.80
Non-Methane Hydrocarbons	0.02	0.02	0.02
Total	10.49	9.07	9.25

Differences between the alternatives are minimal with 13 percent separating the highest and lowest emissions scenarios. To place this in context, the carbon dioxide generated by alternative 1 represents the equivalent of 2.1 million passenger vehicles driven for one year, or the electricity used for one year in 1.7 million homes[p]. While these three alternatives represent the lowest greenhouse gas emission scenarios of all the alternatives, they do the least to prevent large emission pulses from wildfire events not predicted by the state-and-transition or emissions models (see upland vegetation, fire ecology and fuels). This could manifest itself in higher actual emissions than projected.

Effects Specific to Alternative 2

Greenhouse gas emissions projected to occur under alternative 2 are about five times higher than alternatives 1, 3, or 4. However, it is less likely that higher than projected emissions would occur, as this alternative does more to reduce the risk of large emission pulses from wildfire events not predicted by the state-and-transition or emissions models.

Effects Specific to Alternative 5

Greenhouse gas emissions projected to occur under alternative 5 are about 10 times higher than alternatives 1, 3, or 4, or double that of alternative 2. However, it is less likely that higher than projected emissions would occur, as this alternative does more to reduce the risk of large emission pulses from wildfire events not predicted by the state-and-transition or emissions models.

Effects Common to Grasslands

In grassland ecosystems, most of the carbon is stored in the soil. It is inferred from the estimates contained in the assessment report that in the Gila NF at least 93 to 95 percent of the total ecosystem carbon would be in the soil under reference conditions (USDA FS Gila NF 2017). Current biomass

[p] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

carbon is greater than desired in Montane/Subalpine Grasslands and Colorado Plateau/Great Basin Grasslands due to woody encroachment. It is lower than desired conditions in Semi-Desert Grasslands due to a large reduction in the carbon-rich, high ecological status grassland state (USDA FS Gila NF 2017). Modeled results for biomass carbon under each alternative are presented in figure 26 and discussed relative to the alternatives in the subsequent subheading.

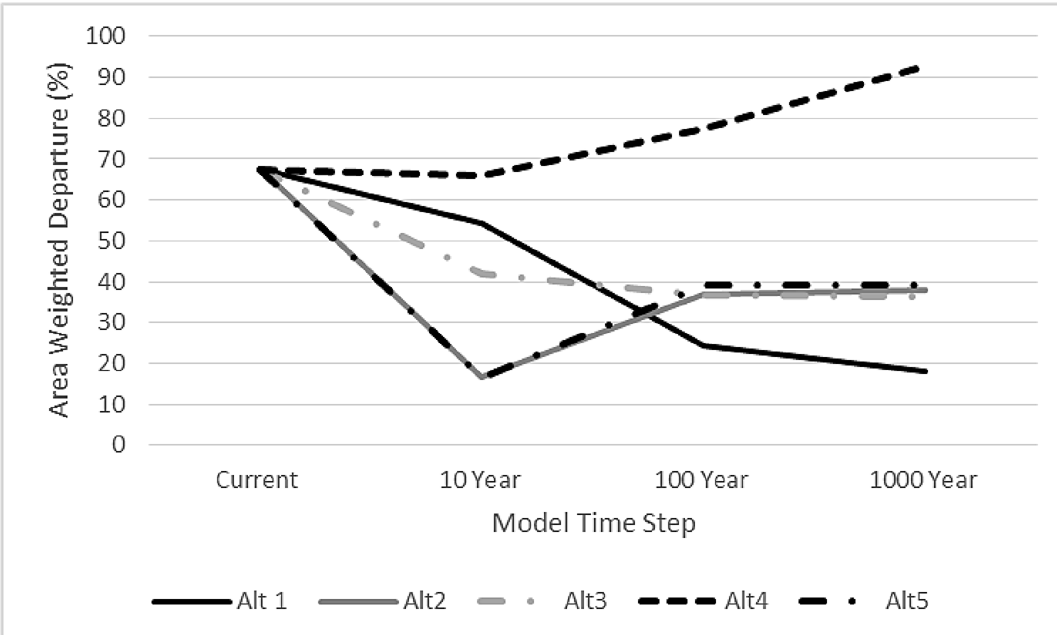

Figure 26. Grassland biomass carbon departure from desired conditions

Alternatives 1, 2, 3, and 5

Woody encroachment into grasslands is commonly thought to increase carbon storage; however, this is not universally true. A study by Jackson and others revealed that it depends on precipitation, with drier sites gaining soil organic carbon and wetter sites losing to the degree that gains in biomass carbon were offset (Jackson et al. 2002). The apparent tipping point between a net gain and a net loss in total ecosystem carbon appears around an average of 19 to 20 inches of precipitation annually (Jackson et al. 2002). The Gila NF has grasslands both above and below the tipping point. The net reduction in woody encroachment observed for these alternatives is responsible for moving toward desired conditions for biomass carbon. While ecologically appropriate in many regards, this is likely to lead to a net gain in total ecosystem carbon storage for upper elevation, higher precipitation grasslands and a net loss of total ecosystem carbon in lower elevation, lower precipitation grasslands. These alternatives all move biomass carbon toward desired conditions, although at different rates and through different treatment methods.

Alternative 4

Alternative 4 does not have treatment objectives for grasslands outside the WUI, which results in an increase in woody vegetation and a movement away from desired conditions for biomass carbon. This leads to a net gain in total ecosystem carbon storage for lower elevation, lower precipitation grasslands and a net loss in upper elevation, high precipitation grasslands (Jackson et al. 2002).

Effects Common to Shrubland

The distribution of total ecosystem carbon in shrublands differs from grasslands. Although most of it is still held in as soil organic carbon, there is a larger percentage held as biomass carbon. It is inferred from the estimates contained in the assessment report that in the Gila NF at least 61 percent of the total ecosystem carbon would be in the soil under reference conditions (USDA FS Gila NF 2017). Current biomass carbon stocks are higher than desired, due to higher proportions of tree-dominated sites. Modeled results for biomass carbon under each alternative are presented in figure 27 and discussed relative to the alternatives in the subsequent subheading.

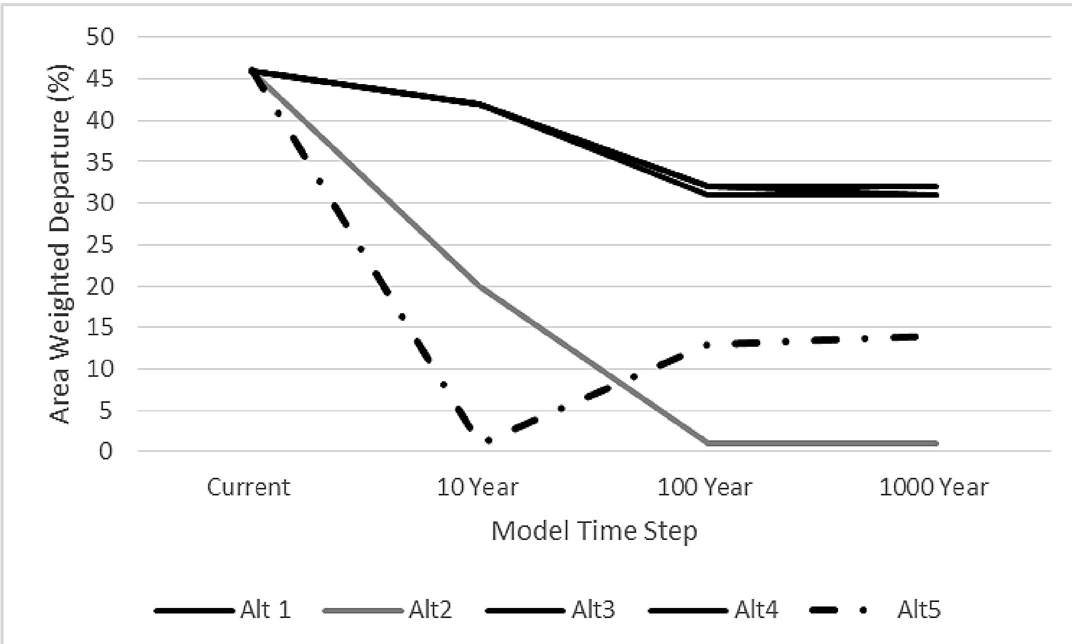

Figure 27. Shrubland biomass carbon departure from desired conditions

All Alternatives

None of these alternatives proposes any shrubland treatments. However, wildfire is projected to continue moving biomass carbon toward desired conditions. While ecologically appropriate on many levels, this means less carbon is stored as biomass. Soil organic carbon, however, may accumulate faster in shrublands as a result of moderate (mixed) severity fire (Feng et al. 1999). However, the timing between fire, re-sprouting response of shrub species, slope gradient, and the precipitation events that follow fire may lead to different outcomes for soil carbon. All of these factors influence erosion rates. Soil loss reduces the amount of carbon held on site. Where soil loss crosses a threshold, it can reduce the site’s ability to generate the same quantity and quality of biomass and soil organic carbon into the future. There remains a fair amount of uncertainty though, as the limited research that was found on this topic comes from the chaparral systems of California.

Effects Common to Woodlands

Similar to other ecosystem types, most of the carbon captured by woodlands is held in the soil. It is inferred from the estimates contained in the assessment report that in the Gila NF at least 60 to 71 percent of the total ecosystem carbon would be in the soil under reference conditions (USDA FS Gila NF 2017). Current biomass carbon is within desired levels for all woodlands except PJ Grass

Woodland, which is outside desired conditions due to young trees infilling openings. Modeled results for biomass carbon under each alternative are presented in figure 28 and discussed relative to the alternatives in the subsequent subheading.

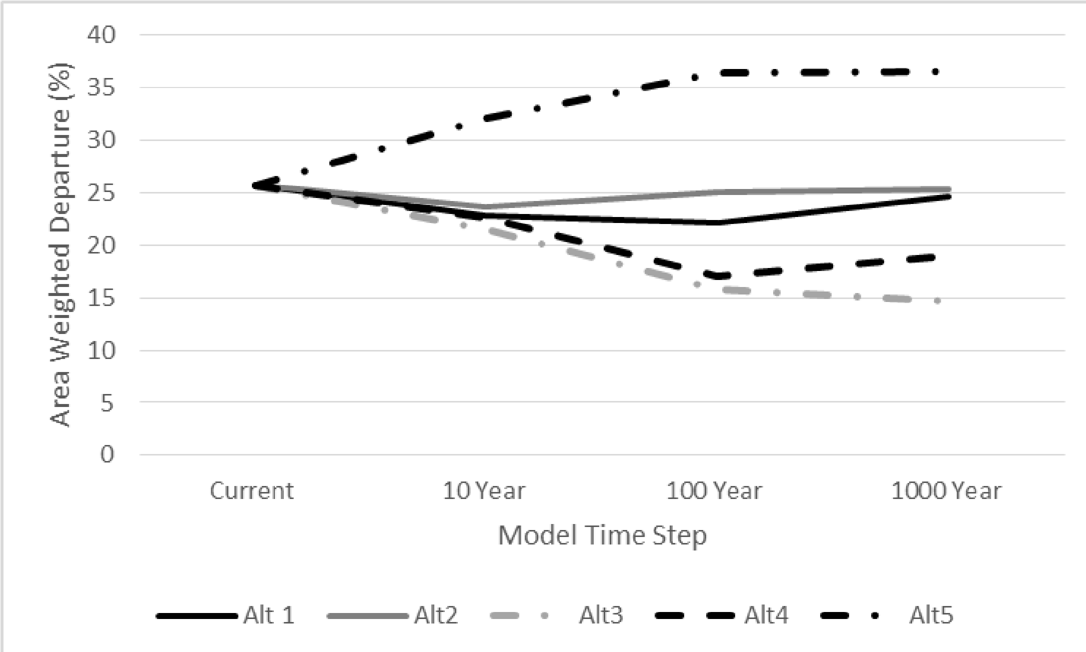

Figure 28. Woodland biomass carbon departure from desired conditions

Alternatives 1, 2, and 3

Carbon dynamics in woodland systems have not been specifically studied to the degree that grasslands and forest/timber types have been, but there are similarities. Work by Rau and others found reductions in biomass carbon following treatments had no effect on soil organic carbon (Rau et al. 2010); however, their study involved a single soil type. Given subsequent work has demonstrated that even low-severity prescribed fire can lead to losses in soil organic carbon (Jian et al. 2018), treatments are likely to maintain current carbon storage in the soil or lead to losses. However, the carbon preserved in the soil by preventing large, contiguous extents of high-severity wildfire are expected to far outweigh losses associated with treatment. These alternatives all maintain biomass carbon within desired conditions.

Alternative 4

Alternative 4 does not have treatment objectives for woodlands outside the WUI, yet still maintains biomass carbon within desired levels, as a result of naturally ignited wildfire.

Alternative 5

Alternative 5 does not use mechanical treatments outside the WUI, relying entirely on prescribed fire and naturally ignited wildfire. However, the number of acres treated per decade lead to movement away from desired conditions for biomass carbon, as tree densities on some sites dip below the 10 percent threshold that is used to differentiate between grasslands and woodland.

Effects Common to Warm Dry Forests

Similar to other ecosystem types, most of the carbon captured by warm, dry forests is held in the soil. It is inferred from the estimates contained in the assessment report that in the Gila NF at least 49 to 79 percent of the total ecosystem carbon would be in the soil under reference conditions (USDA FS Gila NF 2017). Current biomass carbon is within desired levels for Ponderosa Pine Forest and Mixed Conifer-Frequent Fire, but is higher than desired in Ponderosa Pine-Evergreen Oak. Ponderosa Pine Forest and Mixed Conifer-Frequent Fire are the ecosystems that have been researched the most and have a greater likelihood of maintaining net carbon sink if biomass is reduced and fire is returned to its natural role (Hurteau 2017 among others). Modeled results for biomass carbon under each alternative are presented in figure 29 and discussed relative to the alternatives in the subsequent subheading.

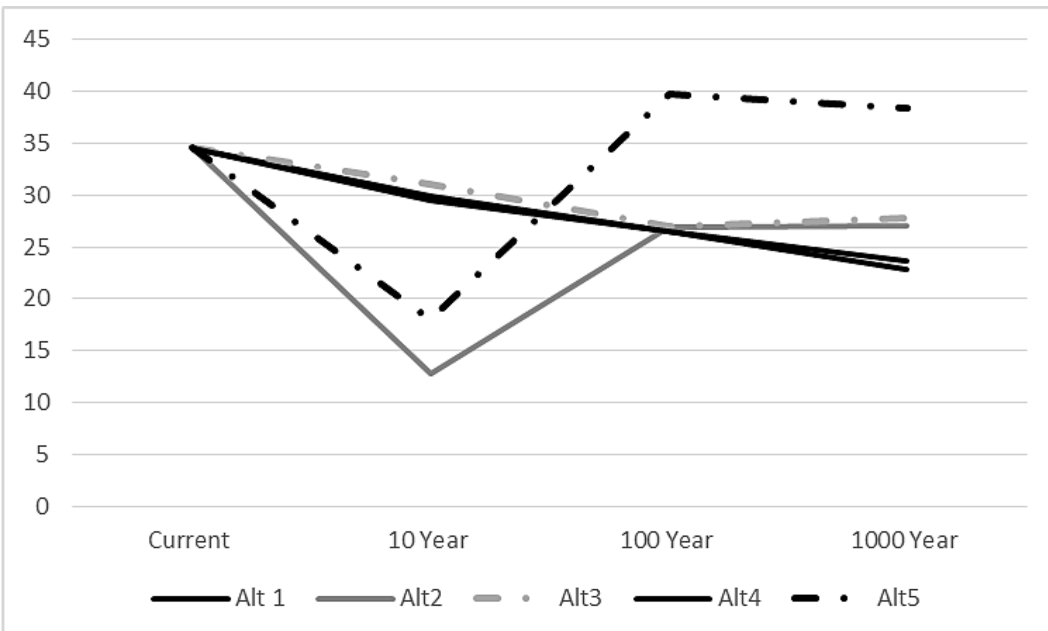

Figure 29. Warm dry forests biomass carbon departure from desired conditions

Alternatives 1, 2, 3, and 4

Under these alternatives, biomass carbon remains within desired conditions for the warm, dry forests as a whole, and slow, steady reductions in biomass carbon move it closer. The differences in treatment methods may contribute to differences in soil organic carbon.

Alternatives 1, 2, and 4

Mechanical treatments can reduce soil organic carbon in forested vegetation communities (Achat et al. 2015), with some studies demonstrating a 25 percent loss in deep carbon storage (Gross et al. 2018). Other studies have shown that the soil organic carbon response is specific to each site, the species it contains, and thinning intensity (Clarke et al. 2015). However, the carbon preserved in the soil by preventing large, contiguous extents of high-severity wildfire is also a consideration that must be weighed. Where treatments prevent such severity distributions, it is likely that retention of soil organic carbon storage outweigh the costs associated with treatment.

Alternative 4

This alternative reduces the use of prescribed fire in favor of more mechanical treatments. Mechanical treatments alone have not been demonstrated to stabilize carbon stocks during future wildfire events to the degree that they can when combined with and are maintained by prescribed fire (Krofcheck et al. 2017).

Alternative 5

Alternative 5 is the only alternative that moves biomass carbon storage further away from desired conditions during the modeled time steps. However, this is due to an increase in open-canopy states dominated by medium to very large trees (see upland vegetation, fire ecology and fuels section). Large trees sequester carbon at a higher rate (Stephenson et al. 2014) and are typically more fire-resistant than smaller trees, which leads to more carbon stability over the long term. Given margins of error associated with the analysis methodology, it is likely that alternative 5 represents the maximum and most stable biomass carbon storage in the warm dry forest types, even though it shows up here as being outside of desired conditions and above the carrying capacity of the system.

Effects Common to Cold Wet Forests

Estimates contained in the assessment report that in the Gila NF suggest the majority of the ecosystem carbon would be expected to be held as biomass under reference conditions (USDA FS Gila NF 2017). This may be the result of soil organic carbon data limitations. Current biomass carbon is within desired levels for Mixed Conifer with Aspen, but is lower than desired in Spruce-Fir Forest due to recent high-severity fire. In these systems, carbon is accumulated and resides over longer time frames, punctuated by infrequent, large emission pulses as a result of high-severity fire. Modeled results for biomass carbon under each alternative are presented in figure 30 and discussed relative to the alternatives in the subsequent subheading.

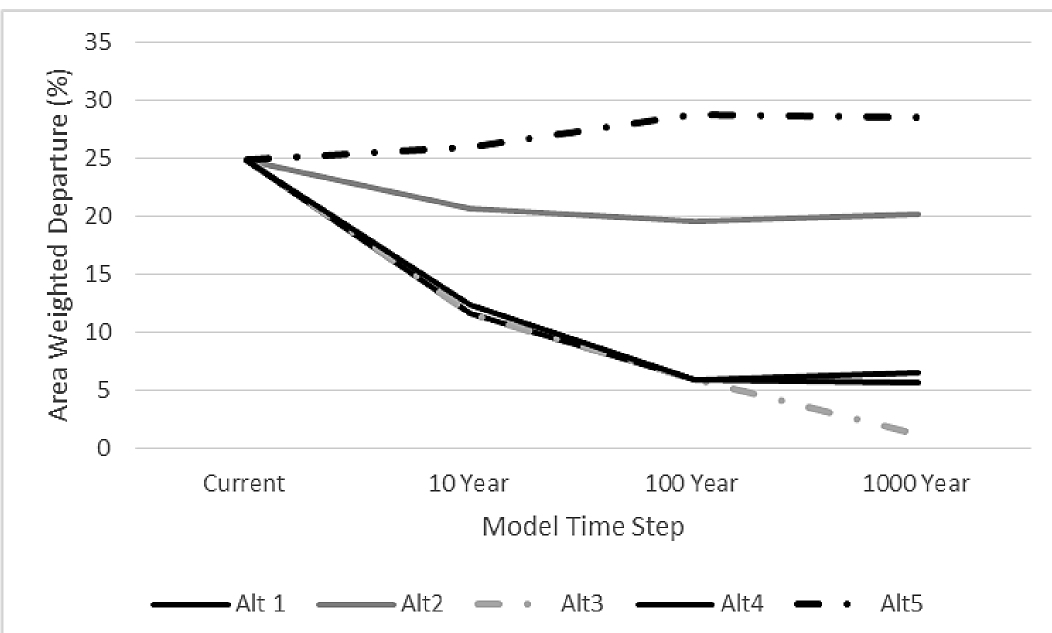

Figure 30. Cold wet forests biomass carbon departure from desired conditions

All Alternatives

These alternatives have limited to no treatment objectives for these vegetation communities, yet biomass carbon storage remains within desired conditions and continues to accumulate into the future. Similarly, soil organic carbon would continue to accumulate. However, carbon stocks increase to a greater degree under alternatives 1, 3, and 4. Alternatives 2 and 5 reduce carbon storage as the increased emphasis on using naturally ignited wildfire as a treatment tool leads to more acres experiencing wildfire. Under alternatives 2 and 5, there may be a risk of permanently reducing carbon carrying capacity, as treatments to reduce wildfire risk in cooler and/or wetter environments may initiate a vegetation type conversion (in sensu Krofcheck et al. 2017). These forests are highly vulnerable to type conversions (see upland vegetation, fire ecology and fuels section), and would likely be replaced by species from lower elevation systems that might not sequester as much carbon.

Effects Resulting from Proposed Research Natural Areas

None of the alternatives propose enough acres for addition to the RNA system to make a measurable difference on management's ability to move toward desired conditions for carbon storage. Neither would detectable effects to greenhouse gas emissions be expected.

Effects Resulting from Recommended Wilderness under the Action Alternatives

While some assert that wilderness mitigates climate change as a result of dedicating large land areas to low-disturbance activities, this isn't necessarily true. Whether a particular recommendation has a positive, neutral, or negative effect on climate change depends on the carbon carrying capacity and current carbon status of the ecosystems contained within that land area.

Similar to the effects analysis of recommended wilderness described for upland vegetation communities, fire ecology and fuels, alternatives 2, 3, and 4 make little difference in management's ability to manage toward desired conditions for carbon storage or emissions, but alternative 5 does. Some of the areas recommended to Congress for wilderness designation under alternative 5 contain large, contiguous areas with moderate or greater probabilities of high-severity fire. Without mechanical treatments, these areas are more likely to experience a net loss of biomass carbon as a result of such fire, and generate large pulses of greenhouse gas emissions.

Cumulative Effects

While management of the Gila NF cannot mitigate global change by itself; its management is additive to similar mitigation efforts being made on other public lands and lands under other jurisdictions and ownerships. Likewise, management of the Gila NF cannot generate enough greenhouse gases to cause or accelerate global change by itself, but it does contribute.

Restoration efforts that include low- and mixed-severity fire in historically frequent, low-severity surface fire ecosystems across lands of all jurisdictions increase the probability of maintaining a net carbon sink into the future. Movement toward sustainable operations in the Gila NF, and other national forests and grasslands, is additive to similar initiatives that are ongoing in other Federal and State agencies and many communities across the Nation. Under the clean air laws and regulations, any contributions that forest management might make toward slowing or stabilizing the rate of climate change through the dimming effect are negligible. Meaningful human influence on global brightening and dimming is largely controlled by developing countries without air quality regulations (Wild 2009), at least for the foreseeable future.

Where vegetation treatments restore the natural role of fire, there is a greater likelihood of maintaining a net carbon sink (Hurteau et al. 2016; Hurteau 2017 among others), but carbon carrying capacities across the Southwest are expected to decline. Furthermore, the ability of restored forests to maintain a net sink could be undermined if predicted widespread, drought-induced mortality events actually occur (Keith et al. 2009; McDowell et al. 2015). Greenhouse gas emissions are also expected to increase as result of restoring the natural role of fire, as wildfire seasons grow longer, and extreme fire weather becomes more frequent. Decreases in biomass carbon could also include decreased forage production, which could lower the carrying capacity of rangelands, leading to a decline in emissions generated by cattle and other ruminants.

While some governments, businesses, communities, and individuals are taking action to reduce their carbon footprints, it is not enough. Given the rate of change being observed, climate change is now unavoidable. Changes must be implemented at a larger scale to provide for the best possible outcomes (USGCRP 2018).

Herbicide-Use Environmental Consequences

The following discussion of environmental consequences addresses the effects of the herbicide use on climate, carbon stocks, and emissions.

Analysis Methodology

This is a qualitative analysis supported by the available published literature as cited in the text.

Effects Common to All Herbicide-Use Alternatives

All of the alternatives authorize the use of some herbicides on some number of noxious weeds. Noxious weeds may have a positive, negative, or neutral effect on greenhouse gas emissions, depending on the structural and functional characteristics of the species and communities being considered (Cheng et al. 2007; Liao et al. 2008; Bradley et al. 2006). Due to this specificity and the limited number of studies that have been conducted on this topic, analysis of effects on climate change associated with any methods used to control, contain, or eradicate noxious plants would be speculative at best. However, there are differences among the alternatives related to the use of herbicides on native alligator juniper and evergreen oak species for restoration purposes.

Effects of Herbicide-Use Alternatives A and C

These alternatives do not propose herbicide use on native alligator juniper and evergreen oak species. Alligator juniper and evergreen oak species proliferate by seed and by re-sprouting. Hazardous fuels and restoration treatments open up the forest canopy and create warmer, drier site conditions that favor re-sprouting species and provide the physical space, light, and nutrients to stimulate germination and growth from the seedbank. Over the long term, these treatments lead to increase in the abundance and cover of alligator juniper and evergreen oak. While this doesn’t happen everywhere or all the time, it does happen frequently. Furthermore, ladder fuels and fuel connectivity are increased, leading to potential increases in fire severity and size. This has implications both for biomass carbon and for emissions. Frequent maintenance is required, and even with that maintenance, the trajectory remains away from desired conditions. This is not sustainable from many perspectives, including carbon storage and the ability to mitigate emissions generated by smoke. Taking no action to add herbicide as a management tool for these species reduces the number of acres that can be restored and maintained as a net carbon sink into the future.

Effects of Herbicide-Use Alternative B-Proposed Action

Alternative B would authorize the use of herbicide to control the density of native alligator juniper and evergreen oak species to accelerate progress toward desired conditions for vegetation communities, including biomass carbon. This would decrease the need for mechanical re-treatment, allowing resources to be shifted to treating additional acres. Biomass carbon would move toward desired conditions across more acres and increase the forest's ability to maintain a net carbon sink.

Effects of Herbicide-Use Alternative D

The effects specific to alternative D are similar to those for alternative B. However, the use of herbicide would be restricted to the WUI, substantially reducing management's ability to move toward desired conditions for biomass carbon and its ability to maintain a net carbon sink.

Cumulative Effects

The cumulative effects to climate, carbon stocks, and emissions as a result of the herbicide use proposals are similar to the draft forest plan cumulative effects, as herbicide use is a tool to move toward desired conditions. Herbicide use alone on lands of any jurisdiction will not mitigate global change, but more acres could be maintained as a net carbon sink, and emissions reduced as a result. The cumulative effects of herbicide use on noxious weeds is less certain, given that their influence on climate and carbon vary by species (Cheng et al. 2007; Liao et al. 2008; Bradley et al. 2006).

Air Resources

Affected Environment

The Clean Air Act of 1993 (P.L. 88-2006) authorized the Public Health Service, within the Federal Health and Welfare Department, to set standards for auto emissions, expanded local air pollution control programs, established air quality control regions, set air quality standards and compliance deadlines for stationary source emissions, and authorized research on low emissions fuels and automobiles. In 1970, amendments to the Clean Air Act required the EPA to establish national ambient air quality standards (NAAQs) to protect public health. The NAAQS are dynamic in that they change with the emergence of new pollution prevention and monitoring technology and scientific knowledge about effects. Today, there are six criteria pollutants for which standards have been set:

1. carbon monoxide (CO),
2. lead (Pb),
3. nitrogen dioxide (NO_2)[q],
4. particulate matter less than 10 micrometers in diameter (PM_{10}) and particulate matter smaller than 2.5 micrometers in diameter ($PM_{2.5}$),
5. ozone (O_3), and
6. sulfur dioxide (SO_2).

These are known as "primary" NAAQS, and they establish the maximum average volume (concentration) of each pollutant acceptable for inhalation by sensitive populations, such as people with heart or lung diseases, young children, developing fetuses and the elderly, over a given period of time. "Secondary" standards have also been established for certain criteria pollutants to protect the "public welfare from adverse effects to visibility, building integrity, plants and animals." The forest's responsibility with regard to primary and secondary NAAQS is met by applying basic smoke management practices (USDA NRCS and FS 2011; USDA FS 2014a; Blades et al. 2018) and best available control measures (emission reduction techniques) (Blades et al. 2018). Smoke contains combustion gases as various diameters of particulates. The predominant pollutant in smoke is fine particulate matter, both PM_{10} and $PM_{2.5}$ (Ward and Hardy 1991).

If violations of NAAQs occur as a result of prescribed fire, they are subject to national administrative reporting and facilitated learning analyses. These accountability processes are designed to identify the conditions that contributed to the violation and identify measures to prevent violations in the future. Naturally ignited wildfire, whether the management decision is to use that fire for resource benefit or to suppress it, is considered a "natural event" and as such, is exempt from Clean Air Act regulations. Despite the exemption, basic smoke management practices and/or best available control measures are implemented, whenever feasible, as standard practice.

Subsequent amendments to the Clean Air Act (1977 and 1990) established prevention of substantial deteriorations regulations. The pollutants targeted were those contributing to regional haze and visibility impairment, especially sulfates and nitrates, and wet and dry deposition of chemical elements and compounds that contribute to acid deposition. These regulations apply nationwide to designated sensitive air quality areas, nonattainment and maintenance areas. A nonattainment area is a geographic area that does not meet one or more of the Federal air quality standards. Maintenance

[q] NO_2 is an ozone precursor, meaning that over time it breaks down into ozone.

areas are former nonattainment areas that are now meeting air quality standards. While there are no nonattainment or maintenance areas located in the Gila NF, a portion of Grant County was established as a nonattainment area for sulfur dioxide in 1992. This was associated with the old smelter in Hurley, New Mexico, which was demolished in 2007. This area was re-designated as a maintenance area in 2003 (USDA FS Gila NF 2017).

Designated sensitive air quality areas are described as being class I or class II. Class I areas are provided the highest level of air quality protection, while class II areas are subject to somewhat less stringent protection. Class I areas include international parks, national wilderness areas exceeding 5,000 acres, national memorial parks exceeding 5,000 acres, and national parks exceeding 6,000 acres that were established at the time the 1977 amendments were passed. International parks, national wilderness areas, national memorial parks, and national parks meeting the acreage criteria, but established after the 1977 amendments were passed as class II areas. The Gila Wilderness is a class I area. The Aldo Leopold and Blue Range Wildernesses are class II areas, as they were not added to the Wilderness Preservation System until 1980.

Natural events that decrease visibility include volcanic and seismic activity, wildfires, high winds, tornadoes, and hurricanes, among others. Natural visibility conditions and efforts to attain the national visibility goal of "no anthropogenic [human-made] impairment" by 2064 are defined in the Regional Haze Rule (40 CFR Part 51) and further documented in state implementation plans.

States are developing milestones for visibility improvements to reach natural conditions. New Mexico has established a Regional Haze State Implementation Plan designed to remediate current impairments of visibility, including smoke and smog, and to prevent future impairment. The state implementation plan establishes acceptable levels of criteria pollutants that affect visibility, such as particulate matter, and other chemical elements and compounds such as mercury (Hg), sulfates (SO_4) and nitrates (NO_3). The EPA approved the New Mexico state implementation plan in 2012, with the exception of one component related to San Juan Generating Station 77.

The forest's responsibility with regard to visibility involves coordinating with the EPA and State, county, and tribal air regulatory agencies in managing and mitigating the emissions of air pollutants resulting from prescribed fire activities. Specifically, the Gila NF complies with visibility requirements of the Clean Air Act by complying with the State's Smoke Management Program. Again, naturally ignited wildfire, regardless of management strategy, is considered a "natural event" and is exempt from Clean Air Act regulations including the Regional Haze Rule. If conditions prescribed by the Regional Haze Rule and EPA-approved state implementation plan are met, visibility is expected to improve over time within and outside the Gila NF.

According to the assessment report, air quality in the Gila NF is within national and state ambient air quality standards. Based on current and projected emissions inventories, the trend appears to be stable or improving for most pollutants except for particulate matter and sulfur dioxide. While there is currently attainment of NAAQs for these two pollutants, conditions are declining for sulfur dioxide because of emissions along the U.S.-Mexico border. Particulate matter is expected to continue to have episodic periods of very high levels from wildfires and increases in airborne dust from effects associated with increased frequency and severity of drought. While prescribed fires may contribute particulate matter to the ambient air, it does not contribute to the predicted trends, as its associated emissions are typically lower than wildfire (USDA FS Gila NF 2017).

With regard to visibility, the 2064 Regional Haze Rule goal has not been attained, but conditions are stable to improving. While episodic periods of very high levels of particulate matter from wildfires and increases in airborne dust are expected to produce declines in ambient air quality, they are not expected to result in downward trends in visibility (USDA FS Gila NF 2017). This is because recent amendments to the Regional Haze Rule eliminate wildfire smoke and some prescribed fire smoke from the way visibility is assessed. Nevertheless, smoke from wildfires and prescribed fires originating from within and outside Gila NF boundaries is a regular occurrence that has potential to affect the health and/or quality of life for area residents for relatively short periods of time.

While wildland fire has been and is expected to remain the primary source of criteria pollutant emissions generated in the Gila NF, there are other activities that occur in the forest that also contribute. Similar to sources of greenhouse gas emissions, Forest Service operations, motorized uses including forest access, mechanical vegetation treatments and energy and mineral development, and bare soil have potential to act as sources for criteria pollutants.

Plan-Level Environmental Consequences

Analysis Methodology

Although, under every alternative, there are several activities that could occur in the Gila NF that would be sources of emissions, emissions from prescribed fire and naturally ignited wildfire are thought to be the only sources substantial enough to warrant consideration in this analysis. These fires release smoke in amounts relative to the amount of fuels consumed, type of fuels, fuel moisture, area burned, and duration of burning. The forest coordinates with the New Mexico Environment Department to ensure that every planned fire ignition complies with the Smoke Management Program, so no unacceptable adverse impacts to air quality should result from prescribed fire under any alternative. Naturally ignited wildfires, regardless of the fire management strategy, may adversely impact air quality.

Emissions were modeled using the Fuel Fire Tools (FFT) (v 2.0.1020) software application developed by the Forest Service's Fire and Environmental Research Applications Team. Basic input data include fuel moisture, the type of fire (prescribed or naturally ignited), pre-fire conditions (whether fire follows mechanical treatment or not), and severity distribution. The model produces estimates for criteria pollutants such as particulate matter ($PM_{2.5}$ and PM_{10}), and carbon monoxide. For this analysis, the alternatives were modeled based on the parameters used in the state-and-transition models supporting the upland vegetation, fire ecology, and fuels analysis. Alternatives 1, 2, 3, and 4 were modeled under the following assumptions:

- Where prescribed fire acres were less than mechanical treatment acres, it was assumed that all prescribed fire acres followed mechanical treatment.
- Where prescribed fire acres were greater than mechanical treatment acres, it was assumed that prescribed fire followed all mechanical treatments, with the acres in excess of mechanical treatments not associated with mechanical treatment.
- All naturally ignited wildfire acres are assumed to occur on acres not treated mechanically.

Alternative 5 was modeled under the assumption that all fire occurred independent of mechanical treatments. For all alternatives, BlueSky Playground v3.0 Fuel Bed Selector was used to approximate total fuel loading. The remaining inputs were selected based on correspondence with Roger Ottmar, one of the primary developers of the FFT application and a leading expert on fuels. All parameters used to populate the model are available in the project record.

Analysis Results

Figure 31 displays the decadal emissions projected by the FFT modeling by alternative. The results are discussed under the subsequent effects headings.

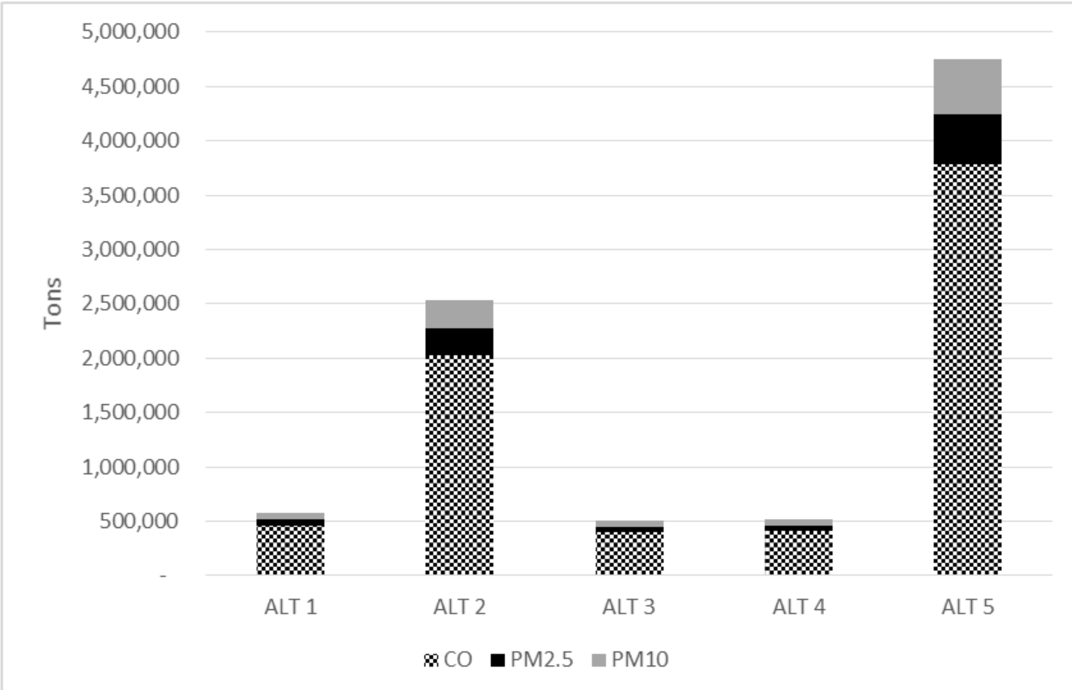

Figure 31. Projected decadal emissions of criteria pollutants

Effects Common to All Alternatives

Smoke from prescribed fire and naturally ignited wildfire is by far the most significant source of air quality impacts that originate in the forest. The predominant pollutant in smoke is fine particulate matter ($PM_{2.5}$ and PM_{10}). Fine particulate matter is known to lodge deeply in the human respiratory system and some may even work its way into the bloodstream (US EPA 2018). Consequently, fine particulate matter can significantly affect the health and well-being of sensitive populations. Sensitive populations include the elderly, young children, individuals with heart and/or lung disease or compromised immune systems. When fine particulate matter rises above a certain threshold concentration and duration, these individuals may experience decreased heart and lung function, which can, and does, lead to death in some cases. While difficult to research, Mokdad and others (2004) estimate that in the United States, 22,000 to 52,000 deaths annually can be attributed to fine particulate matter.

Carbon monoxide concentrations are generally a localized health concern, which is more likely to affect the health and safety of fire personnel. Carbon monoxide poisoning causes headaches, nausea and fatigue, with prolonged exposure leading to brain damage and even death. Brain damage and death is not known to have occurred as a result of occupational exposure within the wildland firefighting community. However, headaches, nausea, and fatigue can lead to reduced cognitive ability, which reduces an individual's ability to maintain situational awareness, recognize rapidly changing fireline conditions, and take appropriate actions to be safe.

Under all alternatives, prescribed fire and naturally ignited wildfire will continue to occur and be managed according to interagency guidance, which is supported by plan direction. Smoke from wildland fires may travel long distances, impairing local and regional visibility and degrading air quality far from their point of origin, depending on topography, wind speed and direction, and other atmospheric conditions. Smoke from naturally ignited wildfire may lead to ambient concentrations of criteria pollutants that exceed NAAQs, regardless of which alternative is ultimately selected.

Emissions of criteria pollutants are driven by wildfire, accounting for 87 to 98 percent of the emission projections. Because naturally ignited wildfire is exempted from Clean Air Act regulations and prescribed fire is conducted in compliance the Smoke Management Program, all alternatives would be compliant with Federal and State air quality regulations.

Effects Common to Alternatives 1, 3, and 4

There are no substantial differences between the criteria pollutant emissions generated under these alternatives. As they represent the lowest emissions scenario, it might be expected that they would have the least associated effects to air quality. However, what they actually represent is greatest likelihood of large emissions pulses associated with wildfire events that could not be predicted by the state-and-transition or emissions models.

Effects of Alternative 2

Alternative 2 represents a significant increase in emissions of criteria pollutants over alternatives 1, 3, and 4, and is anticipated to have greater effects to air quality. However, the unanticipated effects to air quality as a result of wildfire events that could not be predicted by the state-and-transition or emissions models are reduced as compared to alternatives 1, 3, and 4.

Effects of Alternative 5

Alternative 5 represents the greatest increase in the emissions of criteria pollutants. Similar to alternative 2, the anticipated effects to air quality are substantially increased over all the other alternatives, but not all potential wildfire events are predicted by the models; therefore the unanticipated effects are least.

Cumulative Effects

While fire and vegetation management activities in the Gila NF are not the only activities that influence air quality; those activities are additive to those occurring on other public lands and lands under other jurisdictions and ownerships. Population growth and development in Arizona and New Mexico is expected to continue over the life of the plan. As a result, residential and commercial development, including road construction, will contribute fugitive dust to the ambient air. Likewise, an influx of more people would trigger more vehicle traffic on local roads, increasing exhaust and dust emissions. Industrial sources include power plants, factories, mines, and smelters. In the United States, these sources are regulated under permits by state and local environmental agencies. Therefore, if new significant sources of this kind are proposed, regulators would review the increment of criteria pollutants. Mitigation and monitoring would be required to ensure continued attainment of NAAQs. However, regulations lag behind in Mexico, where industrial sources of emissions have increased and are expected to continue to increase (USDA FS Gila NF 2017). Many Federal, State and local agencies; businesses; communities; and individuals are taking action to reduce their energy consumption, and therefore, their emissions of criteria pollutants. This helps to improve or maintain air quality within NAAQs.

Wildfire emissions on Federal public lands are likely to remain one of the Southwest's largest contributor of criteria pollutants, and those emissions are likely to increase with continued projected trends in climate. Emissions associated with prescribed fires on these lands are also expected to increase with continued emphasis on landscape-scale restoration and fuel reduction projects. Federal public lands near large population centers and/or designated municipal watersheds typically get the lion's share of funding to support these projects, which tend to lower the emissions of criteria pollutants when a wildfire does occur. This leaves the Gila NF and other remote forested areas more reliant on naturally ignited wildfire occurring under favorable fuel, moisture, and weather conditions. As a result, these areas are likely to be larger contributors of criteria pollutants now, and into the future.

Herbicide Use Environmental Consequences

The following discussion of environmental consequences addresses the effects of herbicide use on air quality, particularly the emissions of criteria pollutants.

Analysis Methodology

This is a qualitative analysis supported by the available published literature as cited in the text.

Effects Common to All Herbicide-Use Alternatives

All of the alternatives authorize the use of some herbicides on some number of noxious weeds. Similar to their effects on greenhouse gas emissions, noxious weeds may have a positive, negative, or neutral effect the emissions of criteria pollutants, depending on the structural and functional characteristics of the species and communities being considered. Due to this specificity and the limited number of studies that have been conducted on these topics, analysis of effects on air quality associated with any methods used to control, contain, or eradicate noxious plants would be speculative at best. However, there are differences among the alternatives related to the use of herbicides on native alligator juniper and evergreen oak species for restoration purposes.

Effects of Herbicide-Use Alternatives A and C

These alternatives do not propose herbicide use on native alligator juniper and evergreen oak species. Alligator juniper and evergreen oak species proliferate by seed and by re-sprouting. Hazardous fuels and restoration treatments open up the forest canopy and create warmer, drier site conditions that favor re-sprouting species and provide the physical space, light and nutrients to stimulate germination and growth from the seedbank. Over the long term, these treatments lead to an increase in the abundance and cover of alligator juniper and evergreen oak. While this doesn't happen everywhere or all the time, it does happen frequently. Furthermore, ladder fuels and fuel connectivity are increased, leading to potential increases in fire severity and size. This has implications for the emissions of criteria pollutants. Frequent maintenance is required, and even with that maintenance, the trajectory remains away from desired conditions for vegetation and fuels. This is not sustainable from many perspectives, including the ability to mitigate emissions generated by smoke. Taking no action to add herbicide as a management tool for these species reduces the number of acres that can be restored and maintained to more characteristic fuel loading.

Effects of Herbicide-Use Alternative B-Proposed Action

Alternative B would authorize the use of herbicide to control the density of native alligator juniper and evergreen oak species to accelerate progress toward desired conditions for vegetation communities, including fuel loading. This would decrease the need for mechanical re-treatment, allowing resources to be shifted to treating additional acres. Fuel conditions would move toward desired conditions across more acres and increase the forest's ability to maintain lower emissions of criteria pollutants.

Effects of Herbicide-Use Alternative D

The effects specific to alternative D are similar to those for alternative B. However, herbicide use would be restricted to the WUI, substantially reducing management's ability to move toward desired conditions for vegetation and fuels as compared to alternative B, but would still be an improvement over alternative A.

Cumulative Effects

When boom-mounted or backpack spray methods are used, drift of herbicides is possible. When herbicides that volatilize easily are used, chemicals can enter the air. Drift and volatilization are not expected to produce any long-term ambient air quality impacts. Spray drift is short-term in nature and limited to areas immediately adjacent to the application site. Similarly, the quantity of herbicide that may be released into the air through volatilization is not expected to have a long-term impact on air quality, as volatile herbicides are degraded by chemical reactions induced by sunlight and water. Other activities described in the plan-level cumulative effects analysis that occur at the same time as herbicide applications would add to these air quality effects, but dispersion in the air and the small amount of herbicides released into the air during application would not result in noticeably increased emissions within or beyond the airsheds in which the Gila NF is located. When herbicide is used as a tool to treat re-sprouting species such as alligator juniper and evergreen oak, movement toward desired conditions in open-canopy, frequent fire vegetation communities, herbicide use may actually result in decreased emissions, regardless of the jurisdiction where the application occurs.

Soil and Watershed Resources

Affected Environment

Soils and Soil Condition

The soil resource is a complex and dynamic system that consists of a mineral component, organic matter, air, water, and living organisms resulting from interactions between parent material[r], climate, topography, and organisms over time and space. Soil condition is assessed in terms of its ability to support the long-term productivity of the land, maintain environmental quality, and promote plant and animal health (Doran and Parken 1994, USDA FS 2012a), and is influenced by climate, landscape processes, and human activities. These assessments are based on the status of indicators that reflect the soil's ability to support essential functions, relative to their natural capability.

Current soil condition assessment criteria are found in Forest Service Manual 2550 and in regional technical guidance. The technical guidance, currently under revision, classifies soil conditions as "satisfactory," "impaired," or "unsatisfactory." Conditions are satisfactory when all soil functions are maintained within the soil's natural capability. Conditions are impaired when soil functions are reduced or there is an increased vulnerability to degradation. When soil functions are reduced so that the soil is less resilient to disturbance and the long-term productivity of the land is compromised, conditions are unsatisfactory. Soil functions include nutrient cycling, stability, and hydrologic functions (USDA FS 2012b). The draft revised technical guidance expands on the nutrient cycling function and refers to it as biological function. It also adds a climate regulation function.

Soil functions are essentially the benefits it provides. Soil provides a medium for plant growth and wildlife habitat, as well as habitat for micro and macro soil organisms. A single handful of soil can contain more biodiversity than an entire forest. Soil provides forage for wildlife and domestic livestock, wood products and other construction, landscaping, and industrial materials. It is the foundation upon which the infrastructure we depend on every day is built. Soil regulates the cycling of nutrients, energy, and water. It contributes to the global regulation of greenhouse gases, including methane, nitrous oxide, and carbon dioxide, with the latter being stored as soil organic carbon. Soil also regulates water storage, release, and filtration, and provides for erosion control and sediment retention. It regulates thermal energy, absorbing heat energy when temperatures are high, and releasing it when temperatures are cool.

Each soil has a natural capacity to support a specific level and quality of these services. When land use practices alter soil processes, they alter the ability of the soil to function within this natural capacity. Each individual function is an essential component of a properly functioning soil, and the status of each is interconnected. A change in the status of one function, either beneficial or detrimental, can have synergistic or antagonistic effects on other functions. Figure 32 shows current soil conditions by vegetation type as determined during the assessment. As the revised technical guidance remains in draft, this summary does not include the climate regulation function. More information about how these interpretations were developed and associated assumptions and limitations can be found in that report (USDA FS Gila NF 2017).

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[r] Parent material describes both the primary origin of the matter from which soil is formed, either geologic or organic, and its last mode of transport. Modes of transport include flowing water, standing water, wind and gravity.

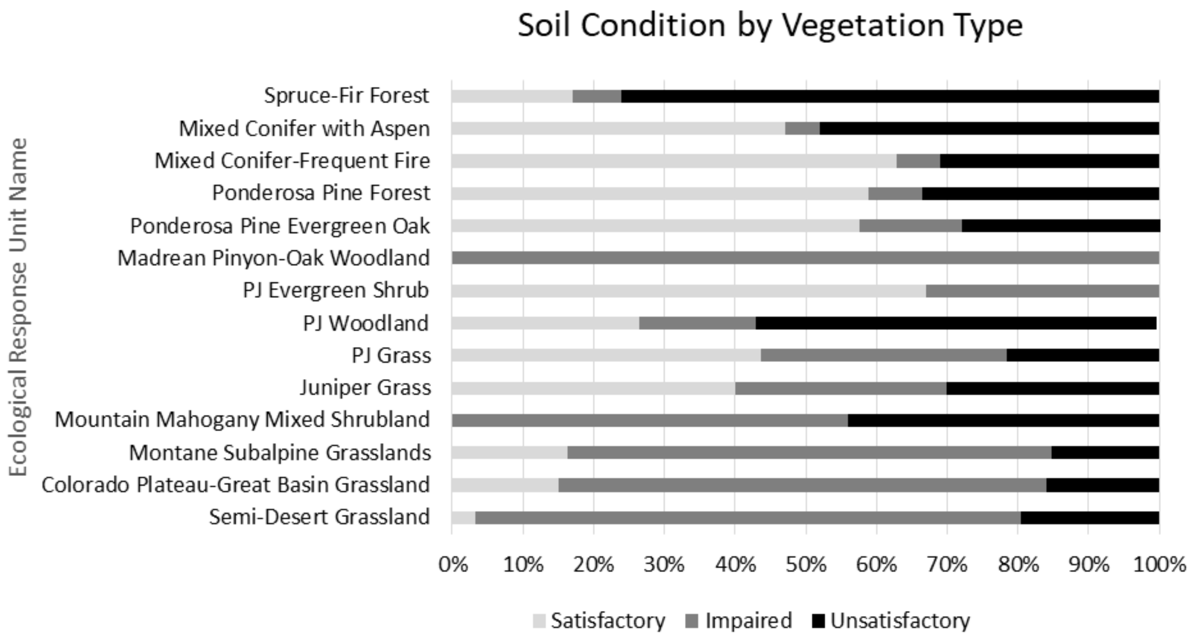

Figure 32. Soil condition distribution by ecological response unit in the Gila National Forest

Cycles of drought, fire, livestock grazing, timber harvest and fuelwood cutting, and road and trail construction and maintenance, have all caused varying degrees of soil impacts. None of these management factors have acted in isolation; rather it is the combination of these management factors, historical and current, that are responsible for existing soil conditions in most vegetation types.

Generally speaking, flatter landforms such as mesa tops and valley plains have experienced greater non-fire management impacts than steeper slopes, regardless of vegetation type. On steeper slopes, fire management is the primary activity influencing soil condition. Although some of these soils may be naturally unstable, fire management can and does accelerate soil loss on these already unstable slopes, as well as steep slopes that have more natural stability due to geology and soil properties.

Post-fire effects are the primary driver of impaired and unsatisfactory conditions in Spruce-Fir Forest and Mixed Conifer with Aspen. This environmental analysis recognizes the scientific evidence that strongly suggests that fire, and therefore, the associated fire effects in these two ERUs, were probably not outside the historic range of variability (Margolis et al. 2011; Schoennagle et al. 2004). However, part of the Forest Service's charge is to maintain favorable conditions of water flow and manage for the long-term productivity of the land. The agency is also charged with managing for human time scales, not geologic time scales. Soil loss dramatically reduces the ability of the agency to meet these objectives, and could become a more substantial management challenge in the future. While there is no vulnerability assessment specific to soils, climate change impacts to the soil resource are likely. Feedbacks between predicted hydrologic, disturbance regime, and vegetation changes could increase bare soil, reduce all soil functions, and affect the long-term productivity of the land and ecosystem service delivery.

Watersheds and Watershed Condition

Watersheds are a topographic extent, or area, that drains to a single point in a stream or river system. They are cataloged using a uniform hierarchical system developed by the U.S. Geological Society

(USGS). The United States is divided and subdivided into successively smaller "hydrologic units." There are six levels of hydrologic units: region (1st level), subregion (2nd level), basin (3rd level), subbasin (4th level), watershed (5th level), and subwatershed (6th level). The hydrologic units are arranged within each other from the smallest (subwatersheds) to largest (regions). This analysis uses the "subbasin," "watershed," and "subwatershed" terminology. Numeric hydrologic unit codes (HUCs) can be found in appendix D of the assessment report (USDA FS Gila NF 2017).

Watershed condition describes the status of the physical and biological characteristics and processes within a watershed that affect hydrologic and soil functions supporting riparian and aquatic ecosystems. Watersheds that are functioning properly have the following characteristics (Potyondy and Geier 2011):

- They provide for high biotic integrity, which includes habitats that support adaptive animal and plant communities that reflect natural processes.
- They are resilient and recover rapidly from natural and human disturbances.
- They exhibit a high degree of connectivity longitudinally along the stream, laterally across the floodplain and valley bottom, and vertically between surface and subsurface flows.
- They provide important benefits to people, such as high-quality water, the recharge of streams and aquifers, the maintenance of riparian communities, and the moderation of climate variability and change.
- They maintain long-term soil productivity.

The Watershed Condition Classification is an interdisciplinary evaluation of watershed condition used across all NFS lands. It offers a systematic, flexible means of classifying watersheds based on a core set of national watershed condition indicators. The classification system uses existing data, local knowledge, professional judgment, written rule sets and criteria. Each of the 12 indicators is composed of one or more attributes. The attributes are scored, summed, and averaged to produce indicator scores, which are averaged within four process categories. The overall watershed condition score is then computed as a weighted average of the process category scores. The final score for each subwatershed results in an overall rating of functioning properly, functioning at risk, or impaired function (Potyondy and Geier 2011).

Table 19 summarizes current subwatershed conditions across the Gila NF. Overall, about 60 percent of subwatersheds are not properly functioning. More information about the Watershed Condition Classification can be found in the assessment report (USDA FS Gila NF 2017).

Table 19. Current watershed conditions in the Gila NF showing percentage of subwatershed area in each condition class

Subbasin	Gila NF Percentage of Subbasin	Functioning Properly	Functioning at Risk	Impaired
Plains of San Agustin	11	100	0	0
Elephant Butte Reservoir	3	58	42	0
Caballo	27	19	66	15
El Paso-Las Cruces	1	42	58	0
Mimbres	5	12	72	17
Little Colorado Headwaters	3	21	79	0
Carrizo Wash	14	75	25	0
Upper Gila	84	39	54	6
Upper Gila-Mangas	15	25	75	0
Animas Valley	4	0	100	0
San Francisco	81	15	68	17
Total Gila NF Subwatershed Area		**40**	**52**	**8**

Table 20 details the status of watershed condition indicators (Potyondy and Geier 2011) within Gila NF subwatersheds and overall watershed conditions (USDA FS Gila NF 2017).

Table 20. Current status of watershed condition indicators (percentage of subwatershed condition indicators functioning properly)

Subbasin	Aquatic Biota	Water Quantity	Water Quality	Riparian/ Wetland Vegetation	Aquatic Habitat	Soil Condition	Roads and Trails	Forest Health	Fire Regime/ Wildfire Effects	Forest Cover	Terrestrial Invasive Species	Rangeland Vegetation
Plains of San Agustin	89	100	100	89	89	89	33	100	0	100	100	0
Elephant Butte Reservoir	75	75	100	75	50	25	0	100	0	75	100	50
Caballo	41	71	71	29	35	29	18	94	6	71	100	93
El Paso-Las Cruces	60	60	60	40	60	20	20	100	0	60	100	0
Mimbres	21	43	7	21	21	14	21	100	0	79	100	21
Little Colorado Headwaters	50	100	100	50	50	0	0	100	0	100	100	0
Carrizo Wash	80	87	83	80	80	7	60	100	20	100	100	13
Upper Gila	41	41	48	43	46	50	43	98	7	70	98	46
Upper Gila-Mangas	19	69	69	44	38	25	13	100	19	94	100	31
Animas Valley	0	86	29	14	0	0	14	0	100	100	100	14
San Francisco	24	47	56	22	29	25	15	100	4	80	98	7
Forest-wide Area Weighted Average	**38**	**58**	**62**	**40**	**41**	**32**	**28**	**99**	**6**	**77**	**99**	**23**

Common management factors contributing to altered conditions include roads, fire exclusion, or post-wildfire effects including the loss of forest cover and altered streamflow patterns, the presence of non-native aquatic organisms, and rangeland vegetation condition. Rangeland vegetation condition is the result of four primary interacting factors: drought, historic grazing practices, current grazing management, and wildlife populations and patterns of use. Drought interacts with every management factor and contributes to aquatic habitat fragmentation and fuel conditions. Current grazing management has generally allowed for improvement over historic conditions, but predominantly static trends in range conditions (USDA FS Gila NF 2017) indicates current management generally maintains current conditions.

Soil, riparian and aquatic habitat, water quality and quantity indicator conditions generally represent symptoms of natural disturbance processes and/or management activities. Terrestrial invasive species and forest health agents (insects and disease) are not currently substantial contributors to altered conditions, although the threat they pose, and the threat of large contiguous extents of stand-replacing fire is predicted to increase under current and future climatic trends.

The work of Parks and others (2018a), first presented in the upland vegetation, fire ecology and fuels analysis is summarized by subbasin in table 21, describing the relative probability of high-severity fire under average and extreme fire weather conditions—*if* a fire were to occur. Recall that this work does not include predictions for non-treed areas, regardless of how it is mapped in the ERU classification system, which means it is not valid in areas that were previously treed, but are currently in grass or shrub states as a result of stand-replacement fire. It is only valid in grasslands where woody encroachment is present. It is also based entirely on standing fuels, as a comparable dataset for surface fuels is not currently available (Parks et al. 2018b). It also does not include subbasin lands outside the administrative boundary of the Gila NF. While the data are available, it was not requested from the authors.

Table 21. Gila NF subbasin area with predicted moderate or greater probabilities of high-severity fire (2018), showing the percentage of the Gila NF subbasin area in average and extreme fire season weather

Subbasin Name	Gila NF Subbasin Area (Acres)	Average Fire Season Weather (percentage of Gila NF subbasin area)	Extreme Fire Season Weather (percentage of Gila NF subbasin area)
Plains of San Agustin	135,981	34	80
Elephant Butte Reservoir	40,451	16	89
Caballo	211,635	13	57
El Pas-Las Cruces	37,572	5	53
Mimbres	210,291	3	32
Little Colorado Headwaters	13,510	19	71
Carrizo Wash	197,142	39	78
Upper Gila	1,069,298	8	53
Upper Gila-Mangas	198,660	22	71
Animas Valley	59,574	8	57
San Francisco	1,097,373	18	66

Under average fire season weather, the majority of the forest's watersheds are at relatively low risk. As would be expected, under extreme conditions, the majority of the forest's watersheds are at much greater risk. High-severity fire is a major concern for Gila NF staff and stakeholders, as recent wildfires with large patches of high-severity fire have resulted in damaging watershed responses. Some are also concerned about what this may signal, given current and predicted trends in climate. The only forest-specific vulnerability assessment available is the vegetation vulnerability assessment, which was aggregated for the forest's subwatersheds (Triepke 2015). While this watershed vulnerability summary does not consider all elements of watershed function, or the disturbance factors that might result in change, it remains useful as an indicator of where changes are most likely to be observed, and how significant they might be. Table 22 displays the vulnerability summary by subbasin.

Table 22. Subbasin aggregated subwatershed vulnerabilities to climate change, showing percentage of Gila NF subwatershed area by upland vegetation vulnerability category

Subbasin	Low	Moderate	High	Very High
Plains of San Agustin	0	100	0	0
Elephant Butte Reservoir	0	100	0	0
Caballo	0	82	18	0
El Paso-Las Cruces	0	100	0	0
Mimbres	0	98	2	0
Little Colorado Headwaters	0	100	0	0
Carrizo Wash	0	100	0	0
Upper Gila	0	74	26	0
Upper Gila-Mangas	0	82	18	0
Animas Valley	0	2	96	2
San Francisco	0	96	4	0

Surface Water Quantity and Quality

Streams, springs, seeps, wetlands, lakes, stock ponds, reservoirs, and groundwater are important in terms of the forest's ecology, the well-being of people, and the sustainability of communities and ways of life. The forest contains a higher density of streams that flow year round (perennial) than the surrounding landscape, largely because it contains many of the higher-elevation, mountainous watersheds where many streams originate, and where precipitation is higher and temperatures are cooler. Cooler temperatures reduce transpiration and evaporative demand, which helps keep water in streams for longer periods. Streams that flow seasonally (intermittent), and those that only briefly flow in response to precipitation (ephemeral) tend to occur at lower elevation and/or lower positions in the watershed where precipitation is generally lower and temperatures warmer. This makes bedrock type and topography, bank, floodplain and channel bed materials, channel geometry, and the valley size and shape relatively stronger controls on the amount and duration of water availability in these streams.

As these characteristics are highly variable from one watershed to another, intermittent and ephemeral stream density in the forest is highly variable. While hydrologically and ecologically important, there is limited information about water resources associated with intermittent and ephemeral streams. The Gila NF manages approximately 17 percent of the land area in its component subbasins and has about 957 perennial stream miles, which is about 57 percent of the total perennial stream miles (USDA FS Gila NF 2017).

The quantity of perennial streamflow in the Gila NF and in the watersheds beyond its boundaries is dependent on precipitation and temperature patterns. Rainfall runoff contributions are most important from July through October, with groundwater contributions being most important November through June. Although data to quantify streamflow are limited, the available streamflow data demonstrate a substantial decline in overall water quantity for the Mimbres River and San Francisco River near Reserve, but flow in the San Francisco appears to have increased near Glenwood. Other stream systems illustrate smaller upward or downward trends and both increased or decreased variability in flow. The data also demonstrate several trends that are consistent with climate change predictions (USDA FS Gila NF 2017):

1. Average flow in the winter and spring months (December–May) is decreasing.
2. Peak snowmelt runoff is occurring earlier and the snowmelt runoff period is decreasing.
3. The duration of late spring-early summer low-flow periods is increasing.

These trends have serious implications, both in terms of ecological processes and functions, but also in terms of human uses. One of those implications is for water quality[s], specifically stream temperature. Stream temperature (too warm) is the leading water quality impairment in the Gila NF's component subbasins, both within and outside forest boundaries (USDA FS Gila NF 2017). Temperature impairments may be caused by reduction in riparian canopy cover, or changes in stream channel shape and function. Wide, shallow streams absorb more heat energy from the sun than deep, narrow streams. Stream temperatures can also be elevated during low-flow periods. There are also factors associated with measuring stream temperature that can lead to exceedances of the State standards, particularly the location of the temperature recorder in the stream. Most temperature impairments in the forest occur in areas where human influences are least prevalent, such as wilderness areas. At the time of the first documented impairments, these streams very likely expressed natural temperature conditions. Nevertheless, these streams remain impaired for temperature, based on State water quality standards.

The other major water quality issues in the Gila NF are related to excessive nutrients and sediment. Nutrients chemically bond to soil particles, and often enter streams attached to sediment. Excessive concentrations of nutrients can lead to algal blooms, which eventually deplete oxygen concentrations, leading to the death of aquatic organisms. Similar to heat energy, nutrient and sediment concentrations increase during low-flow periods. Excess sediment concentrations, with or without nutrients, can increase turbidity, and negatively impact benthic macroinvertebrate communities. Benthic macroinvertebrates are aquatic organisms without backbones that live on the bottom of waterbodies. The status of benthic macroinvertebrate communities are an indicator of overall aquatic ecosystem health, as many are sensitive to water quality and all are food for other aquatic species. All causes of impairment considered, approximately 124 stream miles of the 203 miles assessed in the Gila NF meet all water quality standards. Approximately 79 stream miles are listed impaired for one or more causes (USDA FS Gila NF 2017).

There are no natural lakes in the Gila NF, although a few depressions do occur that may hold water periodically. The remaining waterbodies are all constructed features. Most are earthen ponds built to provide livestock water, with a secondary benefit of providing water to wildlife. Not all stock tanks hold water year round. Some are poorly located or designed, and many are in need of maintenance.

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[s] Surface water quality is a function of natural physical, biological and chemical variables such as elements present in soils and rocks and biological and chemical contaminants originating from a single point source or from runoff that carries contaminants that accumulate over a landscape. The Federal Clean Water Act is administered by the EPA, although the EPA delegates many functions to the Army Corps of Engineers and state governments. The New Mexico Water Quality Control Commission sets standards that define water quality goals by designating uses, setting criteria to protect those uses, and establishing provisions to preserve water quality. More information related to the regulatory process can be found in the Assessment report.

The most reliable stock ponds are associated with springs or seeps. The New Mexico Department of Game and Fish (NMDGF) has stocked a few of the ponds with non-native fish for recreational purposes. NMDGF also constructed and manages dams that create the three reservoirs located entirely, or in part, in the forest for recreational fisheries purposes. These reservoirs are Quemado Lake, Snow Lake, and Lake Roberts. Bill Evans Lake and Bear Canyon Reservoir are two additional reservoirs that are not located in the forest, but are nearby.

All of these reservoirs have water quality impairments. Quemado Lake, Snow Lake, and Lake Roberts are all listed as impaired for nutrients. Additionally, Snow Lake is listed as impaired for pH and Lake Roberts for mercury in fish tissue. Mercury enters waterbodies primarily through atmospheric deposition associated with pollutants released by coal-fired power plants. Bill Evans Lake is listed for mercury and PCBs in fish tissue. PCB is a chemical compound that was used for a variety of industrial purposes. Even though it was effectively banned in the 1970s, it does not break down easily in the environment and remains a problem to this day. Bear Canyon is listed for nutrients, temperature, and mercury in fish tissue.

While constructed waterbodies provide the benefit of storage, making surface water available to livestock and wildlife, and for recreational purposes over a longer period of time, they alter natural patterns of water flow. Constructed waterbodies act as a control on water flowing downstream, which can be both positive and negative. These features may serve to attenuate floodwaters and potentially reduce negative flooding impacts to human life and property downstream. On the other hand, these features negatively impact natural streamflow patterns, hydrologic connectivity of stream systems, and aquatic habitat connectivity, and tend to increase evaporative losses and reduce groundwater recharge.

In 2010, the New Mexico Water Quality Control Commission designated all perennial streams and associated wetlands located within wilderness areas as Outstanding National Resource Waters. Only those perennial streams and wetlands within wilderness areas carry this designation. These waters are subject to the same water quality criteria as other waters, but receive a higher degree of protection from all human activities that could negatively alter their water quality status; however, almost half of these waters have impairments related to temperature, nutrients, and/or sediment. The previous discussion of the temperature standards apply to Outstanding National Resource Waters, with management contributions to these impairments being largely generated by post-fire effects.

Groundwater Quantity and Quality

Groundwater is equally as important as surface water. The majority of groundwater resources within the forest occur in fractured volcanic and sedimentary rock, and are not considered important sources of groundwater by the State. Portions of important basin fill aquifers[t] do occur to a limited extent on forest, but largely occur in the surrounding context area (NMED 2001). While the forest may not be considered an important reservoir of groundwater overall, it is a very important source of recharge in the basin fill aquifers surrounding the forest. The Gila contributes to groundwater recharge in the Gila-San Francisco, Mimbres, Middle and Lower Rio Grande, Las Animas, Hot Springs Artesian, and Lordsburg Underground Water Basins declared by the New Mexico Office of the State Engineer.

Data provided by the State Engineer's Office indicate that approximately 1 percent of groundwater wells occur in the forest, within its component subbasins. Wells constructed in the Gila NF can be used for domestic, livestock, irrigation, municipal, industrial, and commercial purposes, although not

[t] Basin fill aquifers are thick deposits of sediment that accumulated in valley bottoms.

all wells can be used for all purposes. Most are currently used to provide livestock water, providing a secondary benefit as water for wildlife. Wells in the Gila NF also provide water for 15 drinking water systems associated with recreation and administrative sites.

Groundwater recharge occurs as a result of mountain-front or alluvial mechanisms. Mountain-front recharge is very important in arid and semiarid regions like the Southwest. It occurs as the result of higher precipitation and lower temperatures in the mountainous areas, the relatively shallow nature of mountain soils compared to lower lying area, and fractured nature of the bedrock. Alluvial recharge occurs as a result of high-flow events, originating from forest streams. The importance of alluvial recharge has been emphasized in the Mimbres subbasin (Conover and Akin 1942). Recharge rates are very slow. Studies conducted in arid and semiarid regions suggest that groundwater flowing in these regional aquifers accumulated thousands of years ago, before and during the last ice age, and that very little has accumulated since, rendering groundwater a non-renewable resource (Taylor et al. 2012).

Locally important, but relatively small, shallow alluvial aquifers are found in valley bottoms across the plan area. Groundwater is both recharged and discharged in these aquifers. Zones of recharge and discharge may change over time along any particular stream in response to surface runoff contributions and changes in channel and floodplain location and materials. Perched aquifers are also locally important, although information describing their extent and distribution is not available. These aquifers support the forest's springs, seeps, and wetlands.

Springs, seeps, and non-riverine wetlands are areas of groundwater discharge. The perched aquifers previously mentioned, are a zone of saturated soils that form above a layer of low-permeability and the main water table. Depression springs are located in low-lying areas where the surface topography corresponds with a near-surface groundwater table. These types of springs typically receive some contribution from surface runoff, as well. Contact springs are associated with abrupt changes in rock type. Springs also occur along fault lines, or where there are joints or fractures in the rock. Springs or seeps may or may not be associated with wetlands or riparian vegetation and some wetlands are not supported by groundwater. Nor do all wetlands support riparian or wetland species; playa lakes, as described subsequently, are an example.

The USFWS National Wetlands Inventory describes wetlands in terms of riverine, freshwater emergent, and freshwater forested/shrub. Wetlands that do not rely on groundwater are typically seasonal and occur in low-lying areas where the surface topography does not correspond with a high in the water table, such as playa lakes. While they may support upland vegetation that are adapted to periods of inundation and the salt accumulations that can occur in these systems, obligate wetland or riparian species are typically not present. Very few of these types of wetlands are known to occur in the forest. They do exist to a larger extent outside the forest, notably in the Animas subbasin.

The forest does not have a detailed inventory or assessment of springs and seeps or non-riverine wetlands. Information about the extent and distribution of these features is limited to the National Hydrography Dataset and the USFWS National Wetlands Inventory. The National Hydrography Dataset documents what is known about the location and number of springs and seeps in the plan and context area, but does not indicate if they produce water seasonally, all year long, or if they no longer produce water. The USFWS wetlands dataset provides national coverage, but has not been entirely verified on the ground. According to these datasets, the Gila NF contains 918 of the 2,211 springs and seeps within the 11 subbasins the forest is part of, and 2,718 acres of the total 26,579 acres of non-riverine wetlands. There is no water quality information for these water resource features.

Because these features are relatively small, they are more susceptible to impacts related to management activities. In particular, those that are seasonal or produce relatively small quantities of water may be more likely to dry up as droughts become longer, more frequent and severe. The most substantial risk to springs and seeps from management activity is development. Spring development involves any method or practice that diverts water produced by the spring and/or alters natural water flow paths. Based on the Gila NF's range improvements database, 49 percent of the springs occurring in the forest have been developed to provide livestock water. As with the stock ponds previously discussed, there is no information on the reliability of the water produced from these springs. The relationship between how much water the spring produces, and how much is diverted is important to understand potential risks to ecological sustainability.

There is not a lot of information about groundwater quality, although the New Mexico Water Quality Control Commission has developed regulations to protect groundwater resources. The State of New Mexico also relies on its State Drinking Water Rules that incorporate regulations in the Federal Safe Drinking Water Act and establish additional requirements. The Safe Drinking Water Act and State Drinking Water Rules only apply to public water systems. Groundwater quality monitoring is typically only conducted at facilities with a permit to discharge pollutants or when individuals test their own domestic well water. However, there are a few potential sources of pollutants that could impact groundwater quality in and around the forest associated with old landfills, historic mining activity, leaky underground storage tanks, and septic tanks.

Plan-Level Environmental Consequences

The following discussion of environmental consequences addresses the effects of the alternatives on soil and watershed resources. It does not discuss the effects of soil and watershed management on other resources or resource uses. Those discussions are housed under their respective topic headings. To avoid redundancy, watershed condition indicators relevant to riparian and aquatic ecosystems are not analyzed here. Although they are linked, riparian and aquatic ecosystems are given separate treatment due to their ecological importance.

Analysis Methodology

Soil Condition

Soil condition is analyzed qualitatively, with inferences drawn from the climate and upland vegetation, fire ecology and fuels analyses and peer-reviewed published literature as cited in the analysis. The types and amounts of planned activities, and the trends in biomass carbon and the ecosystem characteristics analyzed for vegetation communities provide a sense of what the effects to soil functions might be under a given alternative, in terms of the likelihood of high-severity fire. Given this analysis draws on other analyses, all of the associated assumptions are also relevant here. Additional assumptions include the following:

- Vegetation treatments, wildland fire, motorized use and the transportation system, and livestock grazing are activities that have the potential to impact watershed condition at the scale of this analysis. The impacts of other activities that may occur under a given alternative have relatively localized effects and are not relevant at this scale.
- Energy and mining activities remain at current levels.

Watershed Condition

Watershed condition is analyzed qualitatively, with inferences being drawn from the soils, carbon, upland vegetation, fire ecology and fuels analysis, and other peer-reviewed published literature as cited in the analysis. The assumptions relevant to the analysis of soil condition also apply to watershed condition

Area Designations

Area designations can influence how the forest manages for ecosystem characteristics. Designations that substantially change the allowable types of activities, equipment, and/or modes of access and travel have the potential to influence the extent and distribution of effects, and at times, the outcomes of management activities. Area designations with this potential include designated wilderness, recommended wilderness, designated and proposed RNAs, IRAs, and other administrative designations. Those effects depend on the designation, amount of area involved, vegetation types and conditions that exist within that area, and the terrain. Terrain can limit the types of activities, equipment, and/or modes of access and travel just as effectively as a designation.

The effects of proposals or recommendations for new area designations in each alternative are discussed qualitatively relative to these management factors and evaluated based on whether they are consistent with opportunities to move toward desired conditions soil and watershed resources or whether they detract from those opportunities. Existing designated wilderness and IRAs are not discussed. As these are designated through legislation, they do not contribute to differences in effects among alternatives. Neither are existing designated RNAs analyzed, because there are no associated differences between alternatives. Special botanical areas proposed under alternatives 2 and 5 are not analyzed, as plan direction for their management does not substantially change the types of activities, disturbances, or associated effects.

Climate Change Impacts

Climate change impacts are primarily considered cumulative effects. The sections discussing the indirect effects of plan direction consider how implementation of a particular alternative addresses those impacts. Impacts can be addressed by promoting resistance and/or resilience to predicted future climate.

Effects Common to All Alternatives

All alternatives include vegetation treatment objectives with some combination of wildland fire and mechanical vegetation treatments. Effects of mechanical vegetation treatments may include reduction or enhancement of soil functions and watershed condition. Compaction caused by heavy equipment can alter patterns of air and water exchange between the soil and the atmosphere, rates of water infiltration, moisture-holding capacity, root distribution, soil microbial activity and nutrient cycling, thereby, affecting all soil functions. There is disagreement in the scientific literature about whether these alterations are mostly beneficial, detrimental, or neutral (Burger et al. 2010, Cambi et al. 2015, Sánchez Meador et al. 2017) and more research is needed. Biological soil crusts, which contribute to nutrient cycling and stability function in some systems, are well adapted to climatic disturbances. However, they are poorly adapted to compressional disturbances such as mechanical treatments, and their contributions to soil functions are reduced.

Soils with higher clay content are more susceptible to compaction, as are those that are wet at the time the activity occurs. Pounds of equipment per square inch and operator skill are additional factors contributing to the degree of soil disturbance. Where compaction is an outcome of mechanical treatments, reductions in soil productivity have been demonstrated on clay soils, while increases have occurred on sandy soils. Loamy soils have not demonstrated a change in productivity (Burger et al. 2010). Natural freeze-thaw or shrink-swell cycles can break up compaction over time, although, depending on the soil and climate, it can persist for decades (Cambi et al. 2015). It also depends on the time between re-entries.

Mechanical treatments also reduce vegetative canopy cover, which reduces raindrop interception. This increases the amount of water that reaches the ground and is available for infiltration, but can also increase the soil's exposure to raindrop impact, detachment, and movement off-site. Conventional thinning treatments (this does not include mastication) can also remove and/or redistribute vegetative groundcover, as well as the surficial soil itself. Destruction of surface soil aggregates can reduce soil organic matter (in the sense of Jian et al. 2018), which is important for nutrient cycling and hydrologic function. Reductions in vegetative cover increase the potential for erosion and sediment delivery to streams, which can lead to declines in water quality. However, on most soils, reductions in vegetative cover are short-term, as the herbaceous response is relatively quick.

Mechanical vegetation treatments have a limited ability to affect water quantity, given that the amount, timing, and distribution of precipitation exerts a far greater and more lasting impact on available surface water than does tree density (Feeney et al. 1998 as cited in Reynolds et al. 2013; Furniss et al. 2010). While small, temporary increases in available water have been measured in areas where total annual precipitation is greater than potential evapotranspiration[u], those increases are temporary and not sustainable over the long-term (National Research Council 2008 in Furniss et al. 2010; Ffolliott and Gottfried 2012). There is also conflicting science on whether or these changes in water balance are likely to increase or decrease vulnerability to climate change (Moreno et al. 2016; Clark et al. 2016; Bradford and Bell 2017). Increases in water quantity are typically associated with decreases in water quality.

As opposed to conventional mechanical treatments, mastication can increase vegetative groundcover as it produces wood mulch, but they can still redistribute the surficial soil and destroy soil aggregates, the effects of which were previously described. The effects of this particular mechanical treatment are not as well understood as others, as it is relatively new. While much remains to be learned, most effects seem to be dependent on mulch depth. Mastication has been shown to increase and decrease soil moisture during the growing season, increase or decrease the availability of some essential plant nutrients, increase vegetative biodiversity (Battaglia et al. 2015), and alter soil microbial communities (Gottfried and Overby 2009).

The masticated fuel beds remain on the ground for long periods of time and have been shown to alter fire behavior in "unexpected and contradictory ways" (Kreye et al. 2012). Given observed longer-duration flaming and smoldering (Kreye et al. 2012), soil burn severity is likely to be higher in these fuels and would result in reductions in soil functions for a period of time, depending on other site and incident-specific factors. Fire effects to soils are discussed in more detail in subsequent paragraphs.

Wildland fire, both prescribed fire and naturally ignited, can be restoration and/or fuels management tools when used alone, or in conjunction with mechanical treatments. However, the degree to which this long-term benefit to soil and watershed resources depends on a variety of incident and site specific factors including, time between re-entries, moderate severity patch size, depth and length of time at which soil heating occurs, the total watershed area occupied by mixed- and/or high-severity

[u] Potential evapotranspiration is a measure of the ability of the atmosphere to remove water from the land's surface through evaporation and transpiration, assuming an unlimited water supply. It changes hourly, daily, monthly, and annually. It increases with exposure to solar radiation, wind, higher temperatures, and lower humidity. Conversely, it decreases with shade, less wind, cooler temperatures, and higher humidity.

patches and landscape position. Fire effects are difficult to predict, given the highly variable circumstances under which fires can occur, even when they are managed for resource benefit.

Fire can remove vegetative canopy and groundcover, resulting in effects similar to conventional thinning treatments (not mastication) in terms of the fate of precipitation and potential soil loss, depending on the degree of consumption. In terms of the effects on soil biological and nutrient cycling functions, a recent systematic review of the literature by Sánchez Meador and others suggests that neither mechanical treatments nor prescribed fire used alone produces a substantial effect on the soil microbial community or nutrient availability. However, when used in combination, the effects are generally both substantial and positive (Sánchez Meador et al. 2017). On the other hand, there is literature describing fire effects on soil biological and nutrient cycling functions that indicates the significance of fire effects on soil biological and nutrient-cycling functions, and whether those effects are positive or negative, is dependent on heating thresholds (DeBano 1990, Busse et al. 2014). While it might be that these thresholds are not reached under most prescribed burning conditions, it does happen and can result in enhanced or reduced nutrient availability and microbial activity for a relatively short period of time (Busse et al. 2014). Even low-severity fire can have both positive and negative effects on soil and watershed condition, depending on a variety of site-specific factors and the frequency at which the site is burned. Most negative effects can be mitigated by planning for and integrating fuel, soil quality (Busse et al. 2014), and watershed objectives.

The effects discussed thus far are generally applicable to low and mixed severities, as these are most often associated with restoration and fuels management objectives. Perhaps the most substantial effect to soil and watershed conditions associated with mechanical treatments and/or mixed-severity fire is a reduction in the likelihood of high-severity fire and epidemic levels of insect and disease infestations. This protects favorable conditions of water flow and the long-term productivity of the land.

However, wildfires happen and high-severity fire is a reality that remains under all alternatives. Even when a wildfire happens under conditions that initially support achievement of resource objectives, conditions can change fast. Unexpected wind events happen. Escaped prescribed fires have been rare, but they have and will continue to occur. With more woody vegetation than the landscape than was supported historically, uncharacteristic fuel loading will likely persist for many more decades and when high-severity fire occurs, the negative effects to soil and watershed resources will likely continue to be greater than they were in the past.

Regardless of whether it is characteristic of a given ecosystem, mixed to high-severity fire can have the following effects proportional to the extent and pattern of severities: removal of vegetative cover; accelerated erosion and sediment delivery to streams, accompanied by the loss of soil organic carbon, nutrients (Busse et al. 2014) and productivity; increased peak flow and stream power; alteration of groundwater recharge and discharge patterns; changes in stream channel geometry, gradient and elevation; removal of the riparian/wetland vegetation; changes in the amount and distribution of large woody debris; decreased water quality; and increased risk of invasive and/or noxious weed population establishment or expansion. Some noxious weed species, such as cheatgrass, can alter natural fire regimes potentially leading to a decline in soil functions and watershed condition.

In terms of biological and nutrient cycling function, high-severity fire can result in a net loss of nutrients and reduce the long-term productivity of the land (Debano 1990). Although there can be great variability in effects of high-severity fire on soil biological function (Neary et al. 1999, Pourreza et al. 2014), there is evidence to suggest that fire-related decreases in fungi living on or near the soil surface, in close association with conifers, may be a concern for the long-term productivity of the land. High-intensity surface fires also kill biological soil crusts (Johansen et al. 1993; Belnap et al. 2001), and frequent burning can prevent the recovery of lichens and mosses, leaving only a few species of cyanobacteria (Whisenant 1990), both of which can result in reduced nutrient cycling function.

In addition to total loss of vegetative cover, high-severity wildfire has the potential to sterilize some proportion of the seedbank and create water-repellent soils. Water repellency amplifies these detrimental effects. A reduced or eliminated seedbank increases the amount of time before vegetation becomes established and soil functions begin to recover. Hydrologic and stability function will recover over time, but may never be what it was pre-fire. Depending on the amount of soil loss that occurs, the productivity of the land may only recover on geologic time scales.

Burned areas are more susceptible to invasive and noxious weed establishment and spread. The effects of noxious weed invasion can include displacement of the native vegetation community, a decrease in native species diversity and range, and ecological processes such as fire regimes and nutrient cycling. All of which compromise the integrity of ecosystems, their resiliency and their sustainability. The wind disperses many noxious weed seeds and a proximal seed source is not always needed for recently burned areas to experience invasion.

Post-fire soil and watershed management would also continue in compliance with national Forest Service policy under all alternatives, regardless of whether it is articulated in plan direction. This includes:

- Post-fire rehabilitation, including but not limited to those actions taken to mitigate potential adverse effects to soil stability and hydrologic functions as a result of fire management activities. Examples of post-fire rehabilitation include constructing water bars and scattering slash on dozer lines, and clearing culverts of debris generated by line clearing along roads.
- Burned Area Emergency Response (BAER) and emergency watershed stabilization actions taken to mitigate unacceptable risk downstream values posed by the loss of soil stability and hydrologic function as a result of stand-replacement fire. Examples of emergency stabilization actions include aerial seeding and/or mulching, channel clearing, and replacing culverts with low water crossings along roads in drainage bottoms.

Post-fire rehabilitation can restore natural drainage patterns and re-establish vegetative cover to reduce the decrease in soil stability and hydrologic functions that can result from disrupted drainage patterns and decreased vegetative cover. Emergency stabilization actions that establish vegetative canopy and ground cover at the beginning of the summer monsoon season mitigate the effects of high-severity fire previously discussed. The outcome of both of these activities is a reduction in risk to soil stability and hydrologic function caused by fire management activities and thereby retaining the long-term productivity of the land to the extent possible.

Both of these activities could include the use of certified noxious weed-free seed and other materials as appropriate to site-specific determinations. Many of the areas that have been eligible for Burned Area Emergency Response are likely to re-burn in the future under all alternatives. A recent re-burn in the high country in the Coronado National Forest resulted in a similar watershed response as the previous stand-replacement fire that occurred roughly 18 years before, most likely tied to large quantities of dead and down logs.

Roads and trails facilitate vegetation treatments and wildland fire management. As fire management tools, they provide the ability to maximize the beneficial effects and minimize the detrimental effects previously discussed. They also have detrimental effects to soil and watershed resources that are disproportionately large, as compared to the actual area they occupy on the landscape. Motorized routes are responsible for the most impacts, with open road density, maintenance, and proximity to water largely determining the effects. The forest has a higher motorized route density than it can properly maintain under current and projected future budgets, and many are under-engineered or poorly located.

Road and trail surfaces are necessarily compacted and have relatively little vegetative cover as compared to other areas. Road and trail prisms also alter water flow paths, capture overland flow and concentrate it. This increases velocities and erosive energy. With reduced infiltration rates and minimal vegetative cover present within the road prism, the only controls on runoff and erosion are the drainage features along the road that distribute and slow water. Unfortunately, many of these features can end up serving as nick points that initiate rill and gully erosion if they are not properly maintained. Roads located in drainage bottoms are a particular concern because they act as constraints on the extent riparian/wetland vegetation can occupy and are more effective at delivering sediment to nearby streams. All potential effects associated with the transportation system are anticipated under every alternative. Regardless of the presence or absence of objectives for decommissioning roads closed under travel management decisions, or for road maintenance, no difference between the alternatives results. This will be driven entirely by budgetary constraints. Whatever is accomplished will reduce the negative impacts to soil and watershed conditions caused by the transportation system.

The transportation system also provides permitted livestock producers access to their allotment and facilitate range management. All alternatives provide direction to maintain and improve range condition. Declines in range condition would have detrimental effects on soil and watershed resources through reduced herbaceous vegetative canopy and ground cover and increased bare soil. This could lead to declines in soil functions and condition, water quality, channel shape and function, riparian/wetland vegetation and aquatic habitat. Conversely, improved range condition would increase herbaceous canopy and ground cover and reduce bare soil; thereby supporting soil and watershed resources and movement toward their desired conditions.

Finally, all alternatives include best management practices (BMPs). BMPs are activity, project, and site-specific methods or measures to prevent or mitigate potential adverse impacts to environmental quality, especially water quality. While their primary purpose is to protect against degradation of water quality, they can also protect soil, aquatic habitat, aquatic organisms, and riparian/wetland vegetation. As they are preventative by definition, they cannot improve conditions; they only serve to lessen the degree, extent and/or duration of the effects associated with a given activity or project. Some activity-specific BMPs are included as plan components in every alternative, although the action alternatives are more specific than the no-action alternative. Regardless, BMPs would be implemented for all projects and activities whether plan direction articulates it or not; they are required to comply with the Clean Water Act. Drainage features on the transportation system, restrictions on heavy equipment under wet conditions, and minimum distances between surface water sources and salt and other mineral supplements for livestock are examples of BMPs.

Effects of Alternative 1

Alternative 1 emphasizes timber production, range management, recreation, protection objectives for fire management, and managing for quality Mexican spotted owl and northern goshawk habitat.

Direction specific to the management of soil and watershed resources is minimal. Desired conditions are articulated, but those desired conditions are defined by regulatory standards. Soil and watershed function can be reduced well before it has measurable water quality consequences, and those reductions subsequently reduce the level and quality of services that these resources provide.

Alternative 1 specifies that soil and watershed improvement "should be accomplished through a combination of resource management and watershed structures." This alternative emphasizes the construction and maintenance of watershed structures through objectives. Watershed structures are appropriate in some circumstances, and in those cases, this direction serves to improve soil and watershed conditions. Watershed structures aid in providing for favorable conditions of water flow, slow gully erosion, and over time, can contribute to the recovery of soil functions and watershed condition. However, the emphasis on watershed structures promotes treatment of symptoms, not the root causes of degraded conditions. The number of structures called for in the objectives has also proven to be outside the fiscal capacity of the forest in terms of both construction and maintenance. Under-engineered structures, especially those that fail to consider soil properties, and lack of maintenance can lead to failure. Structural failure often ends up causing bigger problems than the ones they were intended to fix, exposing more land area to more headcutting and gullying and declines in soil condition.

In terms of livestock grazing and range management, this alternative establishes a standard that all allotments must, at a minimum, maintain their current range condition and trend. If current condition is "poor," but stable, it can remain poor and be in compliance with the plan as long as the trend doesn't decline toward "very poor." This has the effect of maintaining the unsatisfactory or impaired soil and watershed conditions that accompany poor and very poor range conditions. It does not promote the recovery of soil functions and the long-term productivity of the land. Nevertheless, alternative 1 also provides science-based utilization guidelines, tiered to existing range conditions, designed to promote improvement where is needed, which in turn leads to improvement in soil and watershed condition.

Under alternative 1, vegetation treatments continue to use mechanical methods, prescribed fire, and naturally ignited wildfire in the way it has been over the last decade. Primarily targeting Ponderosa Pine Forest, and using prescribed fire where canopies are either already open, or if closed, in a single-storied state. Single-storied states have few ladder fuels, and it is much easier to keep fire on the ground and avoid some of the negative fire effects described previously.

On an average decadal basis, alternative 1 is likely to include at least 129,024 acres of planned treatments, with 29 percent being mechanical treatments, and 71 percent being prescribed fire. Prescribed fire acres are anticipated to remain 90 percent low-severity and 10 percent mixed-severity. Also on an average decadal basis, the number of acres of wildfire and the severity distribution is anticipated to remain similar to the last decade, with 605,598 acres and roughly 77 percent being low-severity, 15 percent mixed-severity, and 8 percent high-severity. For more information about how these values were developed, and associated assumptions and limitations, see the upland vegetation, fire ecology and fuels analysis methodology section. Model projections demonstrate progress toward desired conditions for vegetation communities is being made under this alternative. However, progress is slow and some vegetation communities are moving away from desired conditions for one or more characteristics.

A combination of mechanical treatments and predominantly low-severity prescribed fire likely provides for mostly beneficial effects to soil and watersheds on the acres where they are used together (Sánchez Meador et al. 2017). Given predominantly low-severity prescribed fire being is used alone, nothing is substantially changed and the risk of high-severity wildfire and its detrimental effects remains the same. While there are undeniable short-term negative effects resulting from mixed-severity fire, which have been described previously, mixed-severity wildfire provides the long-term benefit to both soil and watershed condition. The mosaic produced by mixed-severity fire limits probable extents of high-severity fire in the future. Overall, this alternative is projected to increase the risk of high-severity fire over time in all watersheds, based on a net increase in closed-canopy conditions across the forest. Alternative 1 does not increase soil and watershed resistance or resilience to climate change.

This alternative also includes slope restrictions, mostly in response to the previous Mexican spotted owl recovery plan, but also as an activity-specific BMP. As a BMP, the intent is to lessen the degree and/or duration of soil stability and hydrologic function impairment as a result of these activities or maintain existing conditions. These standards may also aim to meet a specific requirement of the NFMA. The NFMA requires forest plans to ensure that timber harvest does not occur where "irreversible damage to soil, slope or other watershed condition" is reasonably foreseeable.

Plan direction states:

- Allow no timber harvest in mixed conifer and pine oak on slopes greater than 40 percent where harvest has not occurred in the last 20 years.
- Limit tractor/crawler logging equipment in most areas to slopes less than 40 percent.

As written, no timber harvest is allowed in mixed conifer and pine oak systems on slopes over 40 percent, regardless of reason or equipment used unless it had been harvested in the previous 20 years. In that case, timber harvest is allowable on slopes over 40 percent as long as aerial equipment and cable yarding systems are used. In other vegetation types, it is allowable under the plan to use conventional, ground-based logging equipment on slopes less than 40 percent whether or not they had ever been harvested previously. It is also allowable under the plan to use aerial equipment and cable yarding to slopes over 40 percent in other vegetation types other than mixed conifer and pine oak, regardless of whether or not they had ever been harvested previously.

The no-action alternative also places slope restrictions on other types of mechanical treatments, specifically pushing or chaining. No slope restrictions are specifically provided for mastication, as it is a relatively new treatment method. The direction for pushing and chaining is as follows:

"…treatment through other than fuelwood harvest will be guided by the following criteria:

a) Site potential has a soil production potential rating of moderate or high.

b) Slopes generally less than 15 percent.

c) Limit treatment to soil with low or moderate erodibility index.

d) Treatment results are cost effective."

Similar to the timber harvesting slope restrictions, there are circumstances under which treating slopes in excess of 15 percent is allowable, but those circumstances are not defined. Additionally, no monitoring information sufficient to establish cost effectiveness has been collected on the forest, nor is there any known scientific literature sufficient to make this determination; this direction is not implementable. What does have an effect on soil condition and is not provided adequate consideration in the sum of direction for mechanical treatments includes the following:

- Technological advances in ground-based harvesting equipment include steep slope capabilities.
- Slope being constant, some soils are naturally more susceptible to reductions in stability function than others, regardless of vegetation type.
- The limitations of the erodibility index interpretation.
- Potential fire behavior and the effects of stand-replacement fire on soil functions and conditions relative to the effects of mechanical treatments.

Conventional ground-based harvesting equipment cannot safely operate on slopes over 40 percent. Technological advances have led to ground-based equipment that can operate safely on slopes up to 80 percent. However, there are few scientific studies related to the environmental effects of operating on these steep slopes. Those effects are likely to be similar to those previously discussed, but they may be amplified or diminished, depending on a variety of factors including soil properties and the distribution of the weight of the equipment on the soil surface.

These slope restrictions provide no direct consideration for the fact that some soils are naturally more susceptible to reductions in stability function. The restrictions for pushing and chaining do, but the erodibility index is no longer the best metric to identify these soils. This index is an interpretation derived from a soil loss model that is based on cultivated cropland data. New soil loss models based on wildlands data are available, as are new interpretations. Furthermore, the erodibility index does not necessarily identify soils prone to mass movements such as landslides and debris flows, or fully consider those soils with inherently low resistance and resilience to stressors.

Finally, failure to weigh the site-specific tradeoffs between the effects of mechanical treatments on soil condition and the long-term productivity of the land, and the likelihood of high-severity, stand-replacement fire poses a substantial risk. Both soil condition and the long-term productivity of the land are likely to decline should a fire occur in steep, untreated terrain with large, contiguous areas of higher probabilities of stand-replacement fire.

Herbicide use is not included in the vegetation treatments, but is allowable for both noxious and native species. Herbicide is often, but not always, the only effective tool to control, contain, and eradicate noxious weeds. Native species eligible for treatment are restricted to ponderosa pine, piñon pines, juniper, rabbitbrush and snakeweed where they are encroaching grassland sites. Allowing herbicide as one of many tools to restore and maintain grasslands has the potential to benefit soil and watershed condition in those systems by reducing the need for frequent mechanical treatments where alligator juniper is present, as it typically re-sprouts after cutting and/or burning. Frequent mechanical re-entries tend to create more persistent changes in soil functions. However, it doesn’t allow for herbicide use on evergreen oak species, which also re-sprout after cutting and/or burning and may be located on the same sites as alligator juniper. Furthermore, just 9 percent of the Gila NF consists of grassland communities, and these species have the potential to be a problem in all but Spruce-Fir Forest and Mixed Conifer with Aspen. While their presence is desirable, substantial increases in their abundance and cover is undesirable. Management intends to create conditions that support frequent, low-severity fire. However, when substantial increases in woody understory abundance and cover occur, the result is a self-perpetuating shift to conditions that support mixed- or high-severity fire. Insufficient latitude is provided by alternative 1 to realize the substantial benefits herbicide use could have.

No benefit to the soil or watershed resources is attained by using mechanical methods to treat species that do not re-sprout, such as pines and juniper species other than alligator juniper. Herbicide use is permissible under alternative 1, but it does not authorize it. Neither does it provide supplemental direction for its use, leaving it a matter of law, regulation and policy, including EPA-regulated permitting and reporting to ensure compliance with the Clean Water Act.

Effects Common to All Action Alternatives

All action alternatives include detailed desired conditions for soil and watersheds. They also include objectives designed to benefit soil and watershed resources. This includes improving impaired or unsatisfactory soil condition, in addition to actions to address active headcuts or gully erosion. The objective to implement at least one action annually to improve rangelands in poor or very poor condition also generates movement toward desired conditions, as opposed to the no-action alternative. The action alternatives remove the utilization guidelines, in favor of a standard that simply requires livestock grazing to be compatible with desired conditions for other resources.

Additionally, the action alternatives share common objectives for overall watershed condition, and for the resources affecting the water quantity, riparian/wetland vegetation, aquatic habitat, aquatic biota, and terrestrial invasive species indicators of watershed condition. The objectives for overall watershed condition set a minimum number of subwatersheds that will be improved, allowing for more as budget and partnership opportunities present themselves. They also prevent avoidable declines in watersheds that are currently in proper functioning condition, while being realistic in acknowledging that unavoidable declines could occur because of factors outside the control of management.

In terms of the water quantity indicator, which is intended to capture alterations in flow due to structural controls or diversions on stream hydrology, there is an objective to assess all constructed aquatic barriers over the planning cycle and take appropriate actions. These barriers are tools to aid the recovery of native aquatic species, but can also alter flow depending on their design and location. These assessments have the potential to identify where appropriate actions could improve flow conditions. It also serves to make sure they are functioning as intended in terms of protecting native aquatic organisms, which has the potential to maintain or improve the aquatic biota indicator of watershed condition. The objective to restore or enhance at least 100 miles of stream habitat every 10 years will also maintain or improve both the aquatic biota indicator, as well as the aquatic habitat indicator. The objective to implement at least one riparian improvement project annually, beyond any noxious or invasive weed treatments provides an avenue to improve the riparian/wetland vegetation indicator, as well as the aquatics indicators. Finally, objectives for non-native invasive species have the potential to maintain or improve the aquatic biota or the terrestrial invasive species indicator over the no-action alternative. Taken as a whole, these objectives represent substantially better soil and watershed condition outcomes over the no-action alternative and promote resistance and resilience to climate change.

All action alternatives also include plan standards that impose slope restrictions, allowing for exceptions under specified circumstances. These proposed slope restrictions take soil properties, potential fire behavior, watershed and urban interface values, and all available treatment methods and equipment technologies into consideration. In contrast to the no-action alternative, these standards and the allowable exceptions provide management the flexibility to weigh the trade-offs between the effects of mechanical treatments and foreseeable fire behavior on soil, watershed, and other resource conditions.

Similar to the no-action alternative, herbicide use is allowable under the plan for both noxious weeds and native species. However, there are substantial differences in the level of plan direction provided to guide herbicide use. Plan direction does not specify particular native species that can or cannot be treated. Herbicide use on native species is only allowable if the purpose is to move toward desired conditions for vegetation communities or the WUI. Several plan standards are provided to guide its use for both noxious weed treatments and restoration. While many of these standards reiterate regulation or policy, it helps ensure that herbicides are selected and used properly.

Effects of Alternative 2-Proposed Action

Under alternative 2, the vegetation treatments continue to use mechanical methods, prescribed fire, and naturally ignited wildfire. However, it shifts emphasis to different vegetation communities, tackles more difficult acres, allows for more mixed-severity prescribed fire, and expands the use of natural ignitions. On an average decadal basis, alternative 2 is likely to include at least 100,884 acres of planned treatments, with 34 percent being mechanical treatments and 66 percent being prescribed fire. Prescribed fire acres aim for an 80/20 distribution of low- to mixed-severity fire, as opposed to the 90/10 distribution under alternative 1. The number of wildfire acres could increase as much as 6-fold and still remain within historical frequencies. Although the wildfire severity distribution was necessarily held constant in the vegetation analysis (see the upland vegetation, fire ecology and fuels analysis methodology), allowing this much more wildfire on the landscape could realistically change that distribution. As a result, Burned Area Emergency Response treatments are likely to increase.

However, model projections demonstrate slow progress toward desired conditions for many vegetation communities is being made under this alternative (see Upland Vegetation, Fire Ecology and Fuels). However, there are significant differences between alternatives 1 and 2. Alternative 2 makes less progress toward desired conditions for seral state proportions and snag density, but substantially more progress toward desired conditions for coarse woody debris and reducing the risk of epidemic insect and disease levels as compared to alternative 1. Of course, with more disturbance on the landscape, the threat of invasive and noxious weed establishment and spread increases as a result. Progress toward biomass carbon desired conditions are within 1 percent of alternative 1.

The combination of mechanical treatments and prescribed fire provides a comparable net benefit as compared to alternative 1, but mixed-severity prescribed fire reduces the future extent of high-severity fire providing a long-term benefit to soil and watershed conditions. There is also a greater potential for undesirable fire effects, both short and long term, given management cannot completely control the spatial distribution or patterns of fire severity. Progress toward more sustainable tree densities with greater reliance on fire as a management tool could have implications for soil and watershed resistance and resilience. Where progress is achieved with desired spatial patterns of severity, resistance and resilience will likely increase. However, where undesirable spatial patterns of severity occur, resistance and resilience will decrease. This will ultimately depend on site characteristics, fire weather, and incident-specific management decisions, not on plan direction.

Effects of Alternative 3

Under alternative 3, mechanical treatments are emphasized, and outside of the WUI, only historically open-canopy woodlands and grasslands are treated. The use of prescribed fire and naturally ignited wildfire is identical to alternative 1, except the number of prescribed fire acres is restricted. On an average decadal basis, alternative 3 is likely to include at least 64,208 acres of planned treatments, with 96 percent being mechanical treatments and 4 percent being prescribed fire.

Model projections demonstrate progress toward desired conditions for both vegetation communities emphasized and those that are not (see Upland Vegetation, Fire Ecology and Fuels). However, overall progress is considerably less than under alternative 1. In terms of coarse woody debris, biomass carbon, fire frequency, and the risk of epidemic levels of insects and disease, alternative 3 results in movement away from desired conditions. On the other hand, given the fewer acres of disturbance, the risk of invasive or noxious weed establishment and spread is less than alternative 1.

The number of acres treated with a combination of mechanical treatments and prescribed fire is reduced to the point where no substantial synergistic benefits are provided to the soil, and there are no benefits to watershed outside of the acres treated mechanically. With fewer acres treated overall due the higher cost of mechanical treatments, there is no net reduction in canopy cover. Given that increases in coarse woody debris are projected, the risk of high-severity fire is greater than under alternative 1. Alternative 3 does not substantially improve the resistance and resilience of soil and watershed resources.

Effects of Alternative 4

Under alternative 4, mechanical treatments are emphasized, and outside of the WUI, only forested/timberland vegetation types are treated. The use of prescribed fire and naturally ignited wildfire is identical to alternative 1, except the number of prescribed fire acres are restricted. On an average decadal basis, alternative 4 is likely to include at least 92,799 acres of planned treatments, with 82 percent being mechanical treatments and 18 percent being prescribed fire.

Model projections demonstrate progress toward desired conditions for both vegetation communities emphasized and those that are not (see Upland Vegetation, Fire Ecology and Fuels). However, overall progress is considerably less than under alternative 1. Alternative 4 does reduce the risk of insect and disease infestation to a greater degree than alternative 1, but coarse woody debris, biomass carbon, and fire frequency move away from desired conditions. On the other hand, given fewer acres of disturbance the risk of invasive or noxious weed establishment and spread is less than alternative 1.

The number of acres treated with a combination of mechanical treatments and prescribed fire is reduced to the point no substantial synergistic benefits are provided to the soil and there are no benefits to watershed outside of the acres treated mechanically. With fewer acres treated overall due the higher cost of mechanical treatment, the net reduction in canopy cover is half of that projected for alternative 2. Given that increases in biomass carbon and coarse woody debris is projected, the risk of high-severity fire and its detrimental effects to soil and watershed condition is greater than under alternative 1. Alternative 4 does not substantially improve the resistance and resilience of soil and watershed resources.

Effects of Alternative 5

Under alternative 5, the use of prescribed fire and naturally ignited wildfires are emphasized. Mechanical treatments are only utilized in the WUI. At least 200,593 acres of treatments are planned, with 7 percent being mechanical treatments and 93 percent being prescribed fire. Prescribed fire acres aim for a 60/40 distribution of low- to mixed-severity fire as opposed to the 90/10 distribution under alternative 1. The number wildfire acres could increase as much as 11-fold and still remain within historical frequencies. Similar to alternative 2, the wildfire severity distribution was necessarily held constant in the vegetation analysis (see the upland vegetation, fire ecology and fuels analysis methodology), but allowing this much more wildfire on the landscape could realistically change that distribution. This will likely increase the need for emergency watershed stabilization actions beyond the increase projected for alternative 2.

Model projections demonstrate progress toward desired conditions for many vegetation communities (see Upland Vegetation, Fire Ecology and Fuels). Progress toward desired conditions for seral state proportion is similar to Alternatives 1, but that progress is demonstrated in the greatest net reduction in canopy cover of all alternatives. It also demonstrates the greatest progress toward desired conditions for coarse woody debris and reduction in the risk of epidemic levels of insect and disease. However, more of the forest moves away from desired conditions for biomass carbon and the risk of invasive and noxious weed establishment and spread greater than all the other alternatives. Overall, this alternative does the best at reducing the risk of future high-severity fire, but will likely have cost to soil and watershed resources. There is a greater potential for undesirable fire effects, both short and long-term, given management cannot completely control the spatial distribution or patterns of fire severity. Similar to alternative 2, where progress is achieved with desired spatial patterns of severity, resistance and resilience will likely increase and where undesirable spatial patterns of severity occur, resistance and resilience will decrease. This will ultimately depend on site characteristics, fire weather and incident specific management decisions, not on plan direction. Given the greater risk inherent in the near total reliance on fire as a restoration tool there is a much higher likelihood for undesirable spatial patterns of severity as compared to alternative 2.

Effects Resulting From Proposed Research Natural Areas

Although RNAs can be used to monitor climate change impacts (Massie et al. 2016), areas eligible for designation are in good condition, resulting from the predominance of natural processes. They are not in need of restoration treatments, although that would be allowable if it is needed to maintain the characteristics for which they were designated.

Alternatives 1, 2, and 5 carry forward the proposals for Turkey Creek and Rabbit Trap RNAs that were first brought forward during development of the 1986 forest plan. Alternative 1 also carries forward the proposals for Largo Mesa and Agua Fria RNAs, despite the fact that the updated evaluation found them ineligible for the designation (see RNA process appendix H). Alternatives 3 and 4 do not propose any new RNAs. Despite these differences, there are no substantial effects to soil or watershed condition associated with any of the proposals at the plan scale due to the small number of acres involved.

However, RNAs are intended to provide opportunities for research. Research can expand the scientific understanding and basis for land management decisions, potentially contributing to better management. On this basis, alternatives 2 and 5 provide the greatest opportunities to advance scientific knowledge and improve management. Alternatives 3 and 4 provide no such opportunities. Alternative 1 provides opportunities, but by including proposals for two RNAs that do not qualify for that status, it may also detract from these opportunities.

Effects Resulting From Recommended Wilderness Areas

Under alternative 2, the recommended areas are generally coincident with IRAs and/or areas where terrain naturally constrains modes of access and mechanical treatments and road infrastructure is non-existent. The IRA status, in and of itself, does not preclude mechanical treatments, it just requires specific circumstances to be present and special permissions. In the Gila NF, IRAs were delineated in large part, based on terrain. Whether within or outside IRAs, steep and complex terrain increases the amount of engineering required and the cost of road infrastructure. Conventional ground-based harvesting equipment requires roads to enter an area and remove material, and cannot operate safely on slopes over 40 percent. Specialized equipment is necessary. These areas also do not currently have a predicted potential for large, contiguous patches of high-severity fire, even under extreme fire weather conditions (see Wilderness Process appendix F).

Under alternative 3, the same general conditions are descriptive of recommended areas predominated by grasslands and historically open-canopy woodlands. However, where forested/timberland vegetation communities dominate, terrain may not be limiting and the potential for large contiguous patches of high-severity fire may occur under extreme fire weather conditions. Conversely, under alternative 4, the conditions described for alternative 2 are descriptive of recommended areas dominated by forested/timberland vegetation communities, but those dominated by grasslands and/or historically open-canopy woodlands may also be in relatively gentle terrain and have the potential for large, contiguous patches of high-severity fire under extreme fire weather conditions. Under alternative 5, recommended areas include all of these conditions.

Plan direction for recommended wilderness areas precludes mechanical treatments as it does not conform to maintenance of wilderness characteristics. This has the potential to impact management's ability to move vegetation communities toward desired conditions. While modeling results generally don't suggest a compelling need for mechanical treatments to move toward vegetation desired conditions, the state-and-transition model is not spatial (see Upland Vegetation, Fire Ecology and Fuels). Where there are large, contiguous extents with relatively high probabilities of high-severity fire, strategic placement of mechanical treatments can enhance opportunities to manage fire on the landscape in such a way that the fire effects to soil and watershed condition are mostly beneficial. Beneficial, detrimental and neutral fire effects have been previously discussed as common to all alternatives. Without mechanical treatments, the risk of detrimental effects, and movement away from desired conditions substantially increases.

While any recommended area represents a potential future constraint on management's ability to move toward and maintain desired conditions, the areas recommended under alternatives 2, 3 and 4 are not realistically ever going to see mechanical treatments due to the substantially higher costs per acre that would be involved. Alternative 5, however, recommends a number of areas that could feasibly be treated mechanically and contain large contiguous areas with relatively high likelihoods of high-severity fire. While this alternative does provide for mechanical treatments outside of WUI, if and where strategic placement is demonstrated by scientific analysis, the amount of area recommended to Congress for wilderness designation substantially reduces those opportunities and increase the risk of those detrimental fire effects previously discussed as common to all alternatives.

Cumulative Environmental Consequences

The Gila NF manages watersheds within its boundaries, but watershed boundaries do not follow jurisdiction or ownership boundaries. Excluding private inholdings within the forest's administrative boundary, the upper portions of watersheds are generally managed by the Gila NF and lower portions are managed by other Federal agencies, state and local government and private landowners. Successful management of shared watersheds requires a shared effort. The Gila NF cannot and does not carry the sole responsibility. The Forest Service will continue to work with other Federal and state agencies, local governments, private landowners and non-governmental organizations toward common watershed goals.

The American Southwest is a frequent fire landscape where livestock grazing and hunting have been and remain important to cultural identity and economic sustainability. Historically, overgrazing by livestock and fire suppression contributed to declines in watershed condition and increases in woody vegetation densities. While the fire suppression era has largely ended and contemporary livestock grazing practices have facilitated improved watershed conditions, herbivory by both livestock and wildlife continues to have impacts on watersheds, regardless of jurisdiction or ownership. Those impacts include accelerated soil loss and sedimentation as a result of reductions in the vegetative groundcover, as well as those associated with compaction which have been described previously as common to all alternatives.

The state Departments of Game and Fish manage large elk herds across the Gila NF and the surrounding landscape. Competition for forage between elk and livestock is having a detrimental effect on the soil and watershed condition in many locations across Arizona and New Mexico. As elk are an important game species that bring substantial revenue to state and local economies, current game management is unlikely to change. This means that even with adaptive livestock grazing management, soil and watershed condition will not improve substantially in these areas.

Under current and predicted trends in climate, the collective impact of herbivory by wildlife and livestock is expected to reduce the amount and quality of benefits soil and watershed resources are able to provide to people (Beschta et al. 2013). It also leaves these areas continually prone to increases in woody vegetation and without sufficient fine fuels to carry the frequent, low-severity fire that historically kept these areas open. However, there are also many places where it is possible to manage livestock grazing under an adaptive framework for the improvement of soil and watershed condition, which supports the long-term productivity of the land and favorable conditions of water flow, regardless of jurisdiction or ownership.

With increases in woody vegetation, comes increases in potential fire behavior and severity. Mechanical vegetation treatments, herbicide, prescribed fire and naturally ignited wildfire are tools the Gila NF and others will utilize in an effort to reduce the potential for detrimental post-fire watershed effects, both within and downstream of its administrative boundaries. Prescribed fire and naturally ignited wildfire will also be tools on adjacent lands under the jurisdiction of other Federal land management entities such as the BLM and other national forests. Mechanical vegetation treatments, in conjunction with herbicide use or not, will also continue on these jurisdictions; they are also likely to remain the primary tools on private and state lands.

Fires, like watersheds, do not follow jurisdiction or ownership boundaries; large and small actions on all lands will contribute to risk reduction. However, the current rate of progress is insufficient and will not keep pace with current rates of climate change. Given the broad scope of this issue in the western U.S., there is much more work that needs to be done than there are resources to accomplish it. Resources have been and will likely remain focused watersheds upstream of population densities higher than those associated with the Gila NF and in designated municipal watersheds. Many areas in the Gila NF and on all jurisdictions are likely to remain untreated. Where this is coincident with large, contiguous areas of higher probabilities of stand-replacement fire, soil and watershed conditions are expected to decline as a result of post-fire effects that have been well discussed previously in this analysis.

Furthermore, what are now considered extreme fire weather conditions, are likely to become the norm under future climate. Fire seasons are also predicted last longer, and epidemic levels of insect and disease will change fuel structure and increase dead fuel loading, further increasing the likelihood of high-severity fire. Longer, hotter droughts alone could lead to wide-spread tree mortality, altering fuel structure and loading. Some have projected that visitation to national forests increase, with people taking trips to higher elevation country seeking respite from the heat. This could lead to more human-caused wildfires.

Along with fire-facilitated vegetation changes, increased variability and more frequent extreme precipitation events could further amplify post-fire watershed responses. While there are many interacting factors that influence soil erosion, most can be tied back to precipitation patterns and vegetative canopy and ground cover. Intense rain events can increase runoff, erosion and sedimentation, whether upland soil and watershed conditions are good or poor. Where they are poor as a result of high-severity disturbances or land use, declines in soil and watershed condition are likely to be such that the productivity of the land and conditions of water flow will be fundamentally and permanently altered.

Regardless of jurisdiction, the need for post-fire emergency stabilization to mitigate unacceptable downstream threats to human life and property, and critical natural and cultural resources is likely to increase significantly. However, the success of those treatments could decline. Where emergency stabilization treatments involve aerial seeding, the timing between application date and the onset of the monsoons determines whether or not treatments are successful. With greater variability in precipitation patterns, it will become more difficult to get that timing right. Where emergency stabilization treatments involve watershed structures, they will need to be designed for higher peak flows if they are to do more good than harm. Regardless, impacts to communities downstream of burned areas could become a more frequent and damaging and require more cooperative leveraging of resources to address.

Although increased variability and more frequent extreme precipitation events are projected, higher temperatures are expected to lead to less available water overall, but more water will be needed for plants, animals and people to cope with heat stress. It is also likely that temperature impairments will may increase under the rising air temperatures and longer low flow periods predicted in the future. This poses a risk to State designated, beneficial water uses and may favor warm water aquatic species in streams that historically support cool or cold-water aquatic species.

Working together, across jurisdictional boundaries provides for the best possible outcomes. As drought and water scarcity have always been part of life in the Southwest there is already momentum in that direction. Federal agencies, state and local government, and private citizens across Arizona and New Mexico have been working together on water and watershed issues. However, unless climate change becomes central to the discussions and efforts around water and watershed issues, the resulting plans and projects may be inadequate to address the future. In the current social and political environment, it is just as likely that this will happen as it is that it will not.

Mining is not a substantial activity currently in the forest. However, it is a substantial activity on adjacent lands under other jurisdictions. Mining removes vegetative cover and soil, alters surface and groundwater connections, lowers adjacent water tables and can contaminate soil and water. These activities have the potential to alter surface and groundwater connections, water tables, contaminate soil and water and potentially lead to the decline of riparian and aquatic habitat on lands beyond those they are located on. Such effects are not documented in the Gila NF as a result of adjacent mining activities and it is unlikely that an increase in any of these detrimental effects will by incurred by Gila NF resources.

Reclamation of contaminated abandoned mine lands in the forest, and elsewhere in the Southwest, is ongoing. Whether or not the reclamation is ultimately effective in removing or immobilizing contaminants in the environment depends on the contaminant and actions taken, but in general, this should improve water quality where it has been degraded as a result of historic mining activity.

Similarly, energy production is not a substantial industry in the forest, and any increase in activity is unlikely. However, the forest is impacted by energy generation as far away as the Four Corners region, as emissions from the coal-fired San Juan generating station contribute to mercury deposition in surface water. This will likely decrease in the future as the company that operates this generating station plans to close it in favor of moving toward cleaner sources of energy.

Herbicide-Use Environmental Consequences

The following discussion of environmental consequences addresses the effects of the herbicide-use alternatives on soil and watershed resources.

Analysis Methodology

This is a qualitative analysis supported by the available published literature as cited in the text.

Effects Common to All Herbicide-Use Alternatives

All of the alternatives authorize the use of some herbicides on some number of noxious weeds. Noxious weeds reduce native plant diversity and can alter ecological processes through a variety of mechanisms. Noxious plants can cause changes in soil properties such as pH, alter soil processes such as nutrient cycling, and change the composition and activity of the soil microbial community. Through these effects, nutrient availability is generally reduced, which increases the competition for nutrients between native and noxious plants. Low nutrient levels and changes in the soil microbial community can create a negative feedback loop. Additionally, plants and mycorrhizae are strongly dependent on each other. Mycorrhizae are soil fungi that form a mutually beneficial association with specific plants through their roots. The presence of noxious plants can lead to changes in the mycorrhizal fungal community that could increase the difficulty of reestablishing native vegetation after the invasive plants.

Sites infested by herbaceous noxious plants tend to have reduced and/or redistributed levels of soil organic matter because weeds tend to have deeper roots and less above ground foliage than native perennial herbaceous species. Therefore, these noxious weeds contribute less litter and organic matter at or near the soil surface. Additionally, noxious plant material can decay more slowly than native species (Olson 1999), resulting in reduced rates of organic matter accumulation. This reduces the ability of the soil to sequester carbon and contribute to climate regulation. Hydrologic and stability functions are generally reduced on these sites as total vegetative cover is reduced. Infiltration rates and total volume may be reduced (DiTomaso 2000), evaporation rates higher (Lauenroth et al. 1994), and erosion rates can be significantly accelerated (Lacey et al. 1998), and surface water quality can decline as a result of increased sediment inputs. These changes also contribute to a negative feedback loop with soil biological and climate regulation functions. Watershed conditions decline through these effects to soil, and to those described for vegetation communities in the upland vegetation, fire ecology and fuels analysis.

What happens to herbicide once it enters the soil depends largely on the chemistry of the herbicide and the physical and chemical properties of the soil. Herbicide degrades over time as a result of microbial metabolism and chemical reactions induced by sunlight and water. Soil characteristics such as organic matter, pH, temperature, moisture, clay content and the microbial community can modify certain properties of herbicides like mobility and the length of time it takes to break down. Some herbicides can have transient adverse effect on soil microorganism communities, but there is no documentation describing long-term adverse effects (see appendix K).

Herbicide treatment could affect site productivity over the short-term through changes in the microbial community and in total plant production with effects similar to an infestation as previously described. As noxious species decline, and native vegetation returns to the site, soil functions will return. For the soil resource, the long-term benefits of noxious weed treatment with herbicide substantially outweigh any short-term negative consequences.

In terms of water resources, what happens to the herbicide in the soil determines if and how there is any potential for that herbicide to be leached into the groundwater or transported by runoff to surface water. Sandy, well drained soils have a greater propensity to transfer herbicides to groundwater. Organic rich soils and/or those that are clayey have a higher ability to bind those herbicides and keep them in place until they are degraded. Where conditions are conducive to runoff on these clayey soils, herbicides may be transported to surface water. Herbicide labels identify the soils they are appropriate to be used on and those they are not, and at the application rates typical of Forest Service programs, groundwater contamination really is only a concern with hexazinone (see appendix K). Groundwater contamination can be avoided by considering depth to groundwater when evaluating the specific application scenario(s) for which hexazinone may be an appropriate herbicide. Similarly, surface water contamination can be avoided by selecting the most appropriate herbicide and application method for the situation, employing buffer zones as needed and having a pesticide use plan specific to each scenario in place, including procedures for accidental spills. It remains possible that some herbicide will enter surface water, but it is not expected to result in water quality impairments or result in unacceptable damage to riparian and aquatic ecosystems.

Effects of Herbicide-Use Alternative A-No Action

Alternative A allows all noxious weed species on the NMDA’s noxious weed list as it existed in 2000, with the addition of tree of heaven, to be manually pulled or cut with a chainsaw and/or treated with herbicide. Fourteen different herbicides, all with Forest Service risk assessments, are approved for use, and all methods except aerial application are allowable. No new noxious weeds added by NMDA to the noxious weed list after 2000 are authorized for treatment and no native plant species may be targeted.

Therefore, it does not support EDRR or the maintenance of vegetation communities dominated by native species. When new noxious species designated by NMDA are introduced and/or discovered, time is usually of the essence. The longer noxious weed populations are allowed to persist on the landscape, the greater the risk of spread and the more area that may potentially need treatment. If discovered and treated early, eradication is more likely. If delayed, control or containment may be the only realistic goals, depending on the particular noxious species. This alternative does not facilitate rapid response to emerging threats and compromises management’s ability to maintain adequate vegetative cover and native diversity to protect soil functions and move toward and achieve desired conditions for soil and watershed condition.

Effects Common to All Herbicide-Use Action Alternatives

Alternatives B, C, and D authorize manual removal and herbicide treatments on all noxious weed species listed on the most current APHIS, NMDA, or other state department of agriculture noxious weed lists. Any noxious plant species added to any of these lists after this NEPA decision would be automatically authorized for treatment. Noxious species could be introduced from most places in the United States, and while the climate in the Gila NF may not be conducive to some noxious species now, it may be in the future. Waiting for state listing to authorize their treatment could limit EDRR. Therefore, the action alternatives are more likely to support a successful EDRR program, promote maintenance of adequate vegetative cover and native diversity to protect soil functions, and promote movement toward and maintenance of desired conditions.

As a matter of law, regulation, policy, plan direction, label instructions and risk assessments, site specific soil characteristics, proximity to surface water and depth to groundwater will all be used to determine the appropriate herbicide formulation, application timing and method, and the need for buffers. These design criteria do not eliminate risk, but are tools to keep risk within acceptable levels (see appendix K).

Effects of Herbicide-Use Alternative B-Proposed Action

Alternative B would also authorize the use of herbicide to control the density of native alligator juniper and evergreen oak species in order to accelerate progress toward desired conditions for vegetation communities and the WUI. Through the effects to vegetation communities and fire regimes described in the upland vegetation, fire ecology and fuels analysis, and by reducing the need for frequent mechanical treatments which effects were described in the analysis of the revised Forest Plan alternatives previously in this section, this alternative maximizes the potential for positive soil and watershed outcomes. The rate at which desired conditions are achieved would be accelerated and the need for repetitive mechanical disturbance on the same site would limit any potential negative effects associated with mechanical treatments that has been described in the plan level analysis. Instead of repetitively mechanically treating the same site, new acres could be treated, reducing the risk of detrimental fire effects as described previously in the analysis of the draft forest plan alternatives. With proper use, the effects of using herbicide on more acres would not contribute to any additional effects to soil, surface water quality or groundwater quality over those described as common to all alternatives.

Effects of Herbicide-Use Alternative C

The effects specific to alternative C would be similar to the proposed action without treatment for woody native oak and alligator juniper. This alternative includes utilizing the current noxious weed lists, EDRR, and EPA and Forest Service risk assessments. This would quickly address any new noxious species infestations or new herbicides that have undergone risk assessments.

Effects of Herbicide-Use Alternative D

The effects specific to alternative D are similar to alternative B. However the use of herbicide on alligator juniper and evergreen oak would be restricted to the WUI, reducing the area that could potentially see the benefits described for alternative B.

Cumulative Effects

The cumulative effects described for upland vegetation, fire ecology and fuels, are also relevant to soil and watershed condition. In addition to those effects, using herbicide to promote restoration will reduce the number of mechanical entries necessary to maintain the trajectory toward desired conditions for vegetation a particular piece of ground. This allows for more new acres of restoration treatments and reduces the risk of large, contiguous patches of high-severity fire, thereby reducing those cumulative impacts to soils and watersheds both within and outside the Gila NF’s administrative boundary. Similar treatments on lands under other jurisdictions that limit the potential for fire originating on those lands to move onto the forest would also reduce cumulative impacts to soil and watershed condition within the forest’s administrative boundary. Most of the jurisdictions that use herbicides are required by law to follow risk-reduction measures, similar to many of those described in this document. Government agencies applying herbicides must meet all acceptable levels of water quality protection. Non-governmental jurisdictions do not typically use large amounts of herbicides. Therefore, there is a low risk of exceeding levels of concern for surface water quality and aquatic ecosystems.

Riparian and Aquatic Ecosystems

Affected Environment

Riparian areas are affected by the presence of surface and subsurface, perennial or intermittent, flowing or standing bodies of water. They are composed of distinctively different vegetative species than adjacent areas where water is more limited. In these systems, terrestrial and aquatic ecological processes are integrated within watersheds.

Riparian areas are more productive than other vegetation communities in terms of plant and animal biomass per acre. As a result, they provide some of the most important habitat in the Gila NF and in the Southwest, and are vital to maintaining regional biodiversity (Gregory et al. 1991; Naiman et al. 1993; Patten 1998; Sabo et al. 2005). Aquatic habitats and fish productivity are directly related to the health and function of riparian systems (Knutson and Naef 1997). Therefore, riparian and aquatic ecosystem management have a strong and direct relationship.

The Gila NF contains 12 different riparian ERUs that make up approximately 2 percent of the forest. These ERUs and the relative proportion of the forest's riparian areas they represent are displayed in figure 33.

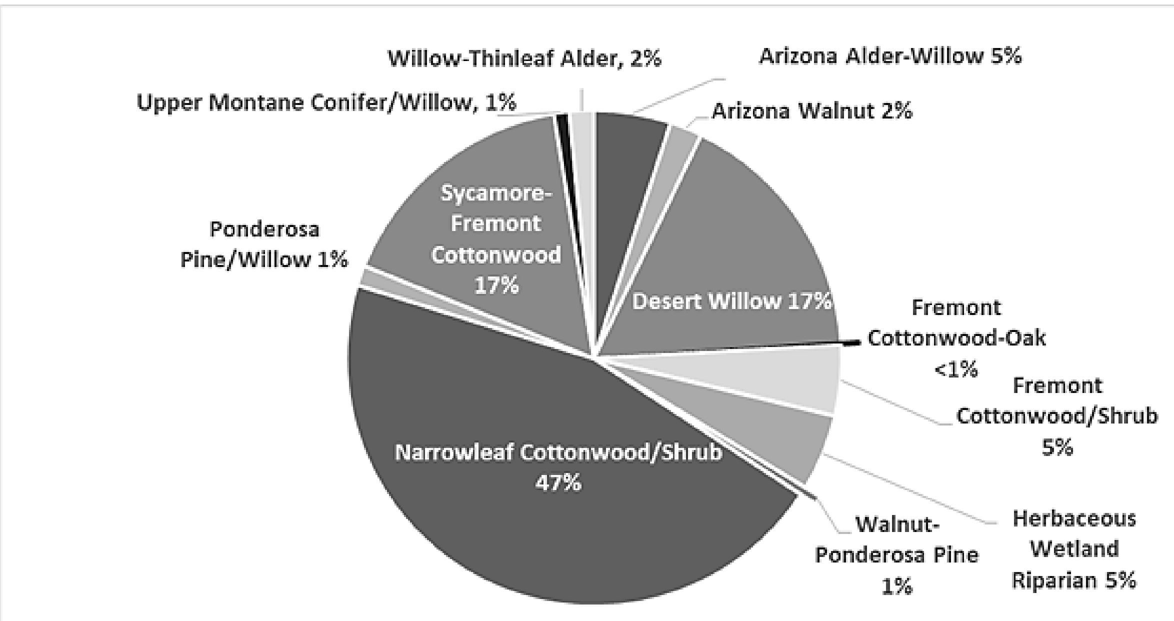

Figure 33. Riparian ecological response units of the Gila NF

The Herbaceous Wetland Riparian ERU may occur along streams, or in upland positions. The remaining riparian areas are predominantly streamside communities. Springs and seeps may support riparian species, but are generally too small to be captured at the ERU scale. Wetlands occur in association with some but not all streamside riparian areas (riverine wetlands). According to the USFWS National Wetland Inventory, the Gila NF's riparian ERUs collectively support roughly 2,700 acres of riverine wetlands and 2,500 acres of non-riverine wetlands (USDA FS Gila NF 2017).

Stream systems and their riparian zones function as important natural corridors for the movement of organisms and materials through landscapes. Riparian corridors are important for migrating animals, such as neotropical birds (Farley et al. 1994; Knutson and Naef 1997; Gentry et al. 2006) and for dispersal for plant propagules (Gregory et al. 1991; among others). Plant propagules include seeds, roots, and stems from which new plants can become established. Movements of species facilitate gene flow on a broad scale, thereby contributing to regional diversity in species and genetic information. Riparian ecosystems can also function as refuges during periods of widespread environmental shifts, such as periods of prolonged drought, thereby conserving regional biodiversity over the long term (Naiman et. al. 2005). Conversely, riparian corridors can also facilitate the dispersal of non-native invasive and/or noxious species that are a threat to local and regional biodiversity.

On the Gila NF, the Gila River supports some of the highest numbers of bird species in the lower 48 states of the United States, including important breeding habitat (Gori et al. 2014). This and other riparian areas on the forest provide essential habitat for wildlife and aquatic species, including federally recognized and proposed threatened or endangered, species of conservation concern, and rare or narrow endemic plants and macroinvertebrates such as snails. Rare species are those that are very uncommon, scarce, or infrequently encountered even though they may not be endangered or threatened. Endemic species are only found in a given region or location and nowhere else in the world. Narrow endemics have a very small geographic distribution and can be specific to a single drainage. Non-native invasive and/or noxious species are present in many of the forest's riparian and aquatic ecosystems. Non-native bluegrass species now dominate some herbaceous riparian communities. Saltcedar and Siberian elm are also notable problems. They mostly occur as isolated individuals or small populations as healthy native riparian communities have not been entirely displaced. There are a few places where this is not the case and Siberian elm in particular has begun to dominate. Non-native aquatic species, such as brown trout, bull frogs and crayfish, are present in many aquatic communities and in some cases have displaced native species.

In spite of these issues, the riparian and aquatic ecosystems in the Gila NF continue to support high levels of genetic and species diversity and numerous other ecological services. Riparian forests exert strong controls on stream microclimate, including temperature regimes, which regulates many biological processes and ecosystem functions. For example, the primary productivity of aquatic plants, organism behavior and water temperature are strongly linked to the amount of solar radiation reaching a stream[v]. Water temperature influences the distribution, metabolism, behavior and life cycle events of stream organisms (Blann et al. 2002; Naiman et al. 2005; Cross et al. 2013). Riparian forests also contribute substantial amounts of organic matter to streams, which is the foundation of stream food webs (Fisher and Likens 1973; Gurtz et al. 1988; Allan et al. 2003; Baxter et al. 2005; among others).

Along with providing nutrients, riparian zones also serve as buffers against pollution from upland runoff and are critical to protecting water quality (for example Clinton 2011; Laudon et al. 2016). Inputs of woody debris from riparian forests influence stream channel shape and function, sediment routing, and instream habitat (Anderson and Sedell 1979 among others). Riparian systems, including their soils, are regionally and globally important nutrient cycling (Naiman and Décamps 1997 among others) and water storage, availability and distribution. Healthy riparian areas slow water movement, which raises the water table, expands the saturation zone and recharges aquifers. They also dissipate stream energy, which can reduce flood damage. The diversity of species and ecological processes in riparian and aquatic ecosystems is sustained by a dynamic water flow regime; natural variability sediment supply and water flow, including floods of different magnitudes, impart considerable

[v] Groundwater interactions are also strongly linked to water temperature, and may be a more important control than solar radiation.

habitat heterogeneity in time and space (Gori et al. 2014 among others). The resulting mosaic of diverse habitats allows a wide variety of species to persist side by side (Poff et al. 1997).

Just as fire plays a role in upland vegetation communities, it also plays a role in riparian and aquatic communities. Fire's natural role within the riparian zone itself is different than those in adjacent upland ecosystems, but there are similarities. With few exceptions, the current scientific understanding is that historic fire frequency and severity in riparian areas may have been less than, greater than or similar to the adjacent uplands depending on a variety of site specific variables (Dwire et al. 2016). Given that the available information to describe fire return intervals is limited to seven studies in the Sierra Nevada mountain range and the Pacific Northwest (Dwire et al. 2016) and what is known about severity is based on inferences drawn from fire behavior and plant species characteristics, any assessment of the status of fire's role in Southwestern riparian systems, including the Gila NF, remains highly speculative. There is far more evidence to support a vulnerability assessment for riparian and aquatic ecosystems, which has not yet been completed. Inferences that might be drawn from the watershed summary of the upland vegetation vulnerability assessment would be highly uncertain due to the complex interactions between climate, fire, water and sediment regimes.

What is certain is that the ability of riparian and aquatic ecosystems to maintain ecological integrity is strongly influenced by, and reflected in, the status of their condition. Based on the available information, some individual riparian areas are functioning properly, but each riparian ERU as a whole, is not in as good of condition or are as resilient as they could be (USDA FS Gila NF 2017). More than half of the subwatersheds containing riparian and aquatic ecosystems are either at risk or impaired (see also soil and watershed resources affected environment). While riparian areas are adapted to disturbance and defined by change, they are susceptible to degradation and loss. These areas are focal points for humans, terrestrial wildlife and livestock; both demand and impacts can be high.

Plan-Level Environmental Consequences

The following discussion of environmental consequences addresses the effects of the alternatives on riparian (including wetland riparian) and aquatic ecosystems. It does not discuss the effects to plant or animal species or resource uses. Those discussions are housed under their respective topic headings. However, the linkages between riparian and aquatic ecosystems and watershed conditions are discussed, as the health and function of each are inseparable.

Analysis Methodology

This qualitative analysis considers riparian and aquatic ecosystems as a whole, not as individual ERUs or groupings of ERUs. Inferences drawn from the soil and watershed and upland vegetation, fire ecology and fuels analyses and peer reviewed, scientific literature. Given this analysis draws on other analyses, all of the associated assumptions are also relevant here. Additional assumptions include the following:

- Where riparian exclosures are deemed necessary, they are maintained in functional condition.
- New Mexico water law remains as is; the state does not legally recognize ecological flow needs and there are no instream water rights.
- Recreation in the Gila NF does not occur at an intensity that contributes substantially to effects at the plan scale.

- Mining in the Gila NF continues at approximately current levels, which does not contribute substantially to effects at the plan scale.

Vegetation Structural Condition

Similar to upland vegetation communities, riparian community structural conditions can be described in terms of seral state proportion. Seral state proportion describes the percentage of a given ERU in each seral state. As defined by reference conditions established by LANDFIRE data, it reflects the structural variability in dominant vegetative lifeform (sparsely vegetated, herbaceous, shrub or tree), woody species canopy cover and size class. Structural variability is the result of ecological processes and patterns over time. It reflects of the status of ecological processes, ecosystem function, integrity and resilience, and habitat abundance and quality. All of these things reflect the sustainability of land use practices.

In contrast to upland vegetation communities, seral state proportion is not modeled because state-and-transition models have not been developed for riparian ERUs, although LANDFIRE data does provide a reference condition for riparian ERU groups that could form the basis for a qualitative analysis. However, the LANDFIRE reference condition is not used here. Gila NF staff decided that a watershed perspective on riparian vegetation structural conditions was more meaningful given the linkages between riparian areas and the upland watershed (Debano and Schmidt 1989 and Hornbeck and Kochenderfer 2000 in Potyondy and Geier 2011).

The Watershed Condition Classification's (WCC) riparian/wetland vegetation condition indicator also addresses seral states (Potyondy and Geier 2011), but at a 6th level watershed, not an ERU level. The riparian/wetland vegetation indicator defines a functioning properly rating as "native mid to late seral vegetation appropriate to the site's potential dominates the plant communities and is vigorous, healthy and diverse in age, structure, cover and composition on more than 80 percent of the riparian/wetland areas in the watershed. Sufficient reproduction of native species appropriate to the site is occurring to ensure sustainability. Mesic (i.e., riparian) herbaceous plant communities occupy most of their site potential. Vegetation is in dynamic equilibrium appropriate to the stream or wetland system" (Potyondy and Geier 2011). This analysis assumes that trends in vegetation structural conditions will generally follow trends in watershed condition.

Ecological Status and Vegetative Functional Diversity

Ecological status is a measure of the species composition of a vegetation community relative to the potential vegetation community. Functional diversity describes the range of characteristics contained in a vegetation community. The ability to re-sprout, or establish from broken stems transported downstream, or the ability to grow under low oxygen conditions are examples of important functional characteristics. Both the number of characteristics (richness) within a given system and the number of species with particular characteristic (redundancy) are important indicators of ecosystem function and resilience. For this analysis, it is assumed that trends in ecological status and functional diversity will generally follow trends in structural condition, and therefore watershed condition.

Vegetative Groundcover

Vegetative groundcover includes basal area, litter, biological crusts, lichens and mosses. Basal area is the area covered by tree trunks and stems of shrubs and herbaceous species where they meet the ground. Litter includes all woody debris and finer plant debris, half an inch or more in depth. It is important for nutrient and energy cycling in riparian and aquatic systems and contributes to site stability. Its residence time on a particular site is naturally synchronized with high flow events, with litter being the most mobile component. For this analysis, it is assumed that trends in vegetative groundcover will generally follow trends in ecological status and structural conditions, and therefore watershed condition. All of the assumptions made in the analysis of watershed condition also apply here.

Channel Shape and Function

Channel shape and function are considered to be functioning properly when "channel width-to-depth ratios exhibit the range of conditions expected in the absence of human influence. Less than 5 percent of the stream channels (in a 6th level watershed) show signs of widening. Channels are vertically stable, with isolated locations of aggradation (sedimentation) or degradation (downcutting), which would be expected in near natural conditions. The distribution of channels with floodplain connectivity is close to that found in reference watersheds of similar size and geology" (Potyondy and Geier 2011). The status of channel shape and function influences vegetative structural condition, ecological status and functional diversity, water flow regime and aquatic habitat quality. For this analysis it is assumed that channel shape and function will generally follow projected trends in watershed condition. All of the assumptions made in the analysis of watershed condition also apply here.

Large Woody Debris

Large woody debris is important for creating habitat in streams and influences channel shape and function. Large woody debris may originate within the riparian area itself, or may be transported into the stream system from the adjacent uplands. For this analysis it is assumed that trends in large woody debris will follow riparian vegetative structural condition, and watershed condition. All of the assumptions made in the analysis of watershed condition also apply here.

Hydrologic Regime

Variability in water flow or availability over time, or the hydrologic regime, influences wetland, riparian and aquatic community structure, function, patterns and processes. Floods of varying magnitudes, and the timing thereof, are vital to the fulfillment of streamside riparian and aquatic species life history requirements (Gori et al. 2014 among others). For this analysis it is assumed that streamflow regimes will follow projected trends in watershed condition. Therefore, all the assumptions made in the analysis of watershed condition also apply to this analysis. Flow regime changes as a result of projected changes precipitation and temperature are addressed as cumulative effects (see also Climate Change Impacts heading below).

Area Designations

Area designations can influence how the forest manages for ecosystem characteristics. Designations that substantially change the allowable types of activities, equipment, and/or modes of access and travel have the potential to influence the extent and distribution of effects and at times, the outcomes of management activities. Area designations with this potential include designated wilderness, recommended wilderness, designated and proposed RNAs, inventoried roadless areas (IRAs), eligible wild and scenic rivers, and other administrative designations. Those effects depend on the designation, amount of area involved, vegetation types and conditions that exist within that area, and the terrain. Terrain can limit the types of activities, equipment and/or modes of access and travel just as effectively as a designation.

The effects of proposals or recommendations for new area designations contained within each alternative are discussed qualitatively relative to these management factors and evaluated based on whether they are consistent with opportunities to move toward desired conditions riparian and aquatic ecosystems or whether they detract from those opportunities. Existing designated wilderness, RNAs and IRAs are not discussed. As these are designated through legislative or administrative processes and there is no authority provided to the revision process to modify them, they do not contribute to differences in effects among alternatives.

Eligible Wild and Scenic Rivers also do not change with alternative and do not contribute to differences among alternatives. To be in alignment with law, regulation and policy, management practices must maintain the free-flowing nature and outstandingly remarkable values (ORVs) specific to each eligible segment. Regardless of alternative, this would be how eligible segments are managed. However, wildfire incidents resulting in large, contiguous extents of high-severity fire and the associated post-fire effects to riparian and aquatic ecosystems, discussed previously in this document and subsequently in this section, may affect one or more of a river's outstandingly remarkable values. This may affect a determination of a river's suitability for designation during the suitability study, but this is highly specific to the circumstances, time and place and totally dependent on whether or not the ORVs or free-flowing nature of the river segment are affected. Should the planning cycle pass into the next plan revision without a suitability study, changed circumstances may necessitate revisiting the eligibility status. Given the temporal and spatial specificity of the circumstances, it is deemed unreasonable to analyze the potential environmental effects.

Special botanical areas proposed under alternatives 2 and 5 are not analyzed as the plan direction for their management does not substantially change the types of activities, disturbances or associated effects.

Climate Change Impacts

Climate change impacts are primarily considered cumulative effects. The sections discussing the indirect effects of plan direction consider how implementation of a particular alternative addresses those impacts. Impacts can be addressed by promoting resistance to change, resilience to change and/or realignment to predicted future climate.

Effects Common to All Alternatives

None of the alternatives contains objectives for riparian and aquatic ecosystems that specifically include mechanical treatments, but they could occur under any alternative. Where there is encroachment of upland species into the riparian area, removing them helps restore subsurface flows from the floodplain to streams (Huxman et al. 2005), community structure, ecological status, and functional diversity. When vegetation communities and flow regimes are restored, riparian and aquatic ecosystems are more resistant and resilient to drought and other disturbance events. However, when heavy mechanical equipment is used to accomplish this, removal of vegetative groundcover, compaction and rutting can occur. Rutting is always detrimental as it channelizes and concentrates water flow, increases potential erosion and sedimentation, and can lead to declines in water and aquatic habitat quality. When this work is conducted with handheld equipment such as chainsaws, these effects are negligible or do not occur.

In severely degraded riparian areas, mechanical equipment could be used to restore channel shape and function, floodplain connectivity, aquatic habitat connectivity and/or as part of restoring native aquatic species to the system. Restoration of native aquatic species can require installation of structures, like fish barriers, that require the use of mechanical equipment. In these cases, the short-term negative impacts associated with increased erosion and sedimentation are outweighed by long-term improvements in conditions of water flow, water quality, community structure, ecological status and functional diversity, aquatic habitat quality and overall resilience. BMPs, such as temporary re-routing of flow, would also help mitigate short-term decreases in water and aquatic habitat quality. BMPs are required as a matter of demonstrating compliance with the Clean Water Act, whether they are specified in plan direction or not (see also soil and watershed resources).

Mechanical treatments targeting the uplands, and prescribed fire and wildfire activities, are more likely to impact riparian and aquatic ecosystems than are mechanical disturbances within the riparian zone. Mechanical treatments in the uplands can lead to short-term declines in water quality, which will be mitigated with BMPs such as buffer zones (for example Laudon et al. 2016), or temporarily stopping operations when conditions are conducive to rutting. Mechanical treatments that reduce the risk of large, continuous extents of high-severity fire are a long-term benefit to riparian and aquatic ecosystems as they help sustain or restore the water, nutrient and sediment regimes that define a given watershed. The same can be said of prescribed and naturally ignited wildfire, under the right fuel and weather conditions.

Whether prescribed or naturally ignited wildfire, fire effects to riparian and aquatic ecosystems are largely a function of the fire severity distribution in a given watershed. In general, low-severity fire supports characteristic water, nutrient and sediment regimes, and therefore riparian and aquatic ecosystem condition, function and resilience. However, in steep watersheds, where geological erosion rates are already high and soils are naturally unstable, even low-severity fire can accelerate water, nutrient and sediment delivery to streams. This may not be uncharacteristic of those watersheds, but when multiple stressors interact in the post-fire environment, such as drought, extreme precipitation events, and herbivory, riparian and aquatic ecosystems may remain vulnerable to degradation for longer periods of time.

Large, contiguous patches of mixed- or high-severity fire, whether characteristic of the vegetation communities in the watershed or not, can have effects on riparian and aquatic ecosystems. While more of an unintended consequence than a deliberate management action, such severities are likely to occur over the life of the plan regardless of which alternative is ultimately selected. The immediate effects include accelerated erosion, nutrient and sediment delivery to streams, increased peak flow and stream power; alteration of groundwater recharge and discharge patterns; changes in stream channel shape and function; removal of the riparian/wetland vegetation; increases in the amount and changes in the distribution of large woody debris; decreased water quality; and increased risk of invasive and/or noxious weed population establishment or expansion. On the other hand, sometimes these changes can favor native aquatic species over non-native species.

Within the riparian zone itself, timing as it relates to pre- and post-fire climatic conditions is an important determiner of ecological effects. Fires that occur early in annual dry periods tend to be lower in terms of severity as fuels and soil moisture remain relatively high. More of the riparian vegetation community is likely to remain intact and what mortality occurs is more likely to be replaced by re-sprout. Fires that occur late in annual dry periods tend to occur at higher severity, as fuel and soil moistures are at their lowest. Less of the riparian vegetation community may remain intact, and root-kill may reduce re-sprout. Periods of drought magnify both fire risk and severity, and reduces the ability of riparian vegetation to re-sprout or regenerate by seed (Dwire and Kauffman 2003; Pettit and Naiman 2007). Management is unlikely to be able to optimize timing, regardless of plan direction. It can, however, it can influence fuel loading.

In some riparian areas, recent drought mortality, lack of flooding disturbance and/or fire has contributed to the accumulation of more large woody debris than is ecologically beneficial. While there are no specific objectives for it, pile and burn operations to reduce fuel loading would be allowable under all alternatives. This could lower fire severity and increase the resilience of the vegetation community when wildfire does find its way into these already stressed environments. If left untreated, when wildfire does find its way into these drainages, the vegetation community may not be able to recover as quickly.

As long as there is water, the post-fire trajectory will be recovery, as all alternatives require preferential consideration be provided to riparian and riparian-dependent resources, with proper functioning condition or a trend toward it being the metric on which preferential consideration is determined. That such preferential consideration does not prevent the exercise of legally recognized water rights or the provisioning of water for livestock under any alternative should go without saying. The first action would be illegal. The second action would not be consistent with the forest's multiple-use mandate, or illegal, or both.

Livestock grazing will continue to affect many riparian and aquatic ecosystems under all alternatives. The effects of which include: reductions in the amount of water available to support riparian and aquatic communities, as well as terrestrial wildlife species (Rasby and Walz 2011); delivery of pollutants to surface water (Armour et al. 1991; Beschta 1997; Sheffield et al. 1997; Nader et al. 1998; Davies-Colley et al. 2004; among others); utilization of herbaceous and woody riparian species and physical stress applied to floodplain and streambank features that are essential for proper function (Warren et al. 1986; Abernethy and Rutherfurd 2001; among others).

However, the outcomes for riparian and aquatic ecosystems depend on how livestock grazing is managed (for example, Lucas et al. 2004; George et al. 2011). Through a mixture of desired conditions, standards and guidelines, livestock grazing under any of the action alternatives will support achievement and maintenance of desired conditions for all riparian and aquatic ecosystem characteristics. Although not articulated through desired conditions in alternative 1, the same effects are achieved through standards and guidelines requiring preferential consideration be provided to riparian areas and their dependent resources, with preferential consideration being established by a condition class of properly functioning, or a trend toward it.

The motorized transportation system facilitates mechanical treatments, fire management and livestock grazing management. It also has disproportionate detrimental effects to riparian and aquatic ecosystems than the amount of area it occupies would suggest. Road and trail prisms alter water flow paths, capture overland flow and concentrate it. This increases velocities, erosive energy and sediment delivery to streams. With reduced infiltration rates and minimal or no vegetative cover present within the road prism, the only controls on runoff and erosion are the drainage features along the road that distribute and slow water. Unfortunately, many of these features can end up serving as nick points that initiate rill and gully erosion if they are not properly maintained. Roads located in drainage bottoms are a particular concern as they act as constraints on natural channel movements, habitat connectivity and the extent riparian/wetland vegetation can occupy and are more effective at delivering sediment to streams given close proximity.

While all alternatives contain some combination of desired conditions, objectives, standards and guidelines designed to avoid or mitigate these detrimental effects, all remain likely under implementation of any alternative. The degree to which these effects occur will be driven entirely by budgetary constraints and travel management decisions. Any road maintenance, realignment or decommissioning that can be accomplished with available funds will reduce sediment delivery caused by the transportation system and improve water quality. Where decommissioning occurs on closed roads in drainage bottoms, the removal of constraints on natural water flow and channel movements, habitat connectivity, and the extent of riparian/wetland vegetation can occupy will also improve ecological processes, function and resilience.

Just as roads allow for human access and travel across the national forest, they can also facilitate the introduction and spread of non-native invasive and noxious species. Similarly, streams and riparian corridors facilitate the movements and life cycle events of native species, but they also facilitate the spread of invasive and noxious species. Non-native invasive and noxious species, both animal and plant, are already present within and/or adjacent to many riparian and aquatic ecosystems. Non-native invasive species can displace native species, alter vegetation structure and lead to declines in ecological status and functional diversity. They can also interfere with natural processes such as nutrient and fire cycles and alter water quality status, which reduces resilience and adaptive capacity. All alternatives direct the use of integrated pest management, but there are differences between alternatives in terms of how direction supports it and promotes prevention, early detection and rapid response to emerging threats.

Alternative 1-No Action

As described for the soil and watershed resources analysis, the upland vegetation treatments that are likely to occur under alternative 1 contribute to progress toward desired conditions for some vegetation types and some characteristics, but the risk of high-severity fire continues to increase. Not enough acres can be treated and a net increase in closed-canopy conditions is likely. This increases the likelihood of riparian and aquatic ecosystems experiencing fire and post-fire effects previously described as common to all alternatives.

Alternative 1 provides no direction specific to the post-disturbance environment, leaving the degree to which continued uses affect riparian and aquatic recovery as a matter of happenstance—to be addressed when an issue is identified. Where issues develop, riparian and aquatic ecosystems remain vulnerable to degradation because of subsequent disturbances. Once corrected, recovery may take longer than it would have, had a more proactive approach been taken, and may require more management inputs to reverse the trajectory away from desired conditions, or it may not; it depends on the particular system and how long the issue existed prior to being identified.

Similarly, alternative 1 provides no direction specific to preventing the establishment or spread of non-native invasive species, nor does it provide direction supporting early detection and rapid response to emerging threats. Without strategic, forest-wide direction, there is a reduced likelihood that effective practices will be consistently implemented which increases the risk to ecological integrity and sustainability posed by new or expanding invasive and noxious species populations.

Effects Common to All Action Alternatives

In addition, the standard requiring preferential consideration, the action alternatives provide a guideline for interdisciplinary evaluation of riparian and aquatic ecosystems after disturbances, such as mixed- and high-severity fire and/or unusually high streamflow events. The purpose of the evaluation is to determine if the area is ready to support the same kinds and intensities of resource uses as it did pre-disturbance, or if some temporary adaptive management action is necessary. This proactive approach will promote shorter recovery times and better provide for resistance and resilience.

All action alternatives have a guideline directing projects and activities to incorporate riparian and aquatic improvements where and when there are reasonable opportunities to do so and it is compatible with the nature and scope of project or activity. At the minimum, the project or activity should not result in a trend away from desired conditions. The more often projects and activities are able to do even small things to promote movement toward desired conditions for riparian and aquatic ecosystems, the greater the rate of progress will be. Additionally, the action alternatives share common objectives for overall watershed condition, and for the resources affecting the water quantity, riparian/wetland vegetation, aquatic habitat, aquatic biota as described in detail in the soil and watershed resources analysis. These objectives support achievement and maintenance of desired conditions to a greater degree than the no-action alternative and promote resistance and resilience to climate change.

The action alternatives also include standards identifying the proper preventative measures and decontamination procedures to prevent the introduction or spread of non-native invasive and/or noxious species and undesirable aquatic disease agents. While these procedures exist as policy outside of plan direction, referencing them promotes awareness across different staff areas and the public, thereby contributing to application that is more consistent. All action alternatives also provide guidelines and management approaches that promote early detection and rapid response to non-native invasive and/or noxious weed introduction and establishment, including objectives for noxious weed surveys. Riparian zones are one of the top priorities for survey. Early detection and rapid response increases the likelihood that infestations can be eradicated before they spread, which protects ecosystem condition, function, resistance and resilience.

Standards, guidelines and management approaches also provide support in the proper selection and appropriate use of integrated pest management tools, including physical, cultural, chemical and biological methods. While chemical use is guided by law, regulation, policy, product label instructions and risk assessments, reiteration in plan direction under the action alternatives promotes awareness and contributes to application that is more consistent. It also serves to minimize the potential off-target impacts and other unintended consequences such as reductions in water quality that can occur if chemicals are not selected and used properly. For example, if there is a possibility an herbicide could travel to streams and cause harm to aquatic species, only those registered for aquatic use are allowed. Herbicides are often the only effective means to contain, control or preferably eradicate noxious weeds and avoid the potential effects of those weeds previously identified as common to all alternatives.

Effects Common to Alternatives 2, 3, and 4

Alternatives 2, 3, and 4 include a guideline that directs new construction or realignment of roads and other motorized routes not be located within the 100-year floodplain or within 300 feet of a riparian zone. Allowances can be made where stream crossings are necessary as long as bridges and/or culverts are designed to not interfere with common high flow events or aquatic organism movements. To a greater degree than alternative 1, this reduces the detrimental effects of the transportation system on riparian and aquatic ecosystems that were previously identified as common to all alternatives.

Alternative 2-Proposed Action

The plan direction differentiating the effects of alternative 2 from those of the other alternatives are the objectives for upland vegetation treatments and the relative emphasis placed on fire as the primary restoration tool. While a mixture of both fire and mechanical treatments are included in this alternative, there is a greater reliance on fire.

As described for the soil and watershed resources analysis, the upland vegetation treatments that are likely to occur under alternative 2 contribute to progress toward desired conditions for some vegetation types and some characteristics, and a small net reduction in tree density is likely. This reduces the likelihood of large, contiguous extents of high-severity wildfire. However, the mechanism by which upland tree densities are reduced is fire. Fire is not a precise tool, and treating more acres with fire necessitates less aversion to risk. Prescribed fire targeting more difficult acres and allowing for more mixed severity, and more acres being treated with naturally ignited wildfire all increase the likelihood that riparian and aquatic ecosystems will experience fire and post-fire effects, which were previously discussed as common to all alternatives. How this relates to condition, function, resistance and resilience will be determined by spatial patterns of severity and extent, which cannot be predicted with the vegetation model used for this analysis (see upland vegetation, fire ecology and fuels analysis methodology).

Alternative 3

The vegetation treatments likely to occur under alternative 3 also contribute to progress toward desired conditions for some vegetation types and some characteristics, but no net reduction in tree density is likely and projected to be accompanied by a net increase in heavy surface fuel loading (coarse woody debris). Restricting the use of prescribed fire results in fewer acres treated and while the risk of large, contiguous extents of high-severity wildfire is less than alternative 1, fire and post-fire effects to riparian and aquatic ecosystems are likely.

Alternative 4

The plan direction differentiating the effects of alternative 3 from those of the other alternatives are the objectives for upland vegetation treatments and the relative emphasis placed on mechanical treatments as the primary restoration tool. The vegetation treatments likely to occur under alternative 3 also contribute to progress toward desired conditions for some vegetation types and some characteristics, but no net reduction in tree density is likely and projected to be accompanied by a net increase in heavy surface fuel loading (coarse woody debris). Restricting the use of prescribed fire results in fewer acres treated and while the risk of large, contiguous extents of high-severity wildfire is less than alternative 1, fire and post-fire effects to riparian and aquatic ecosystems are likely. These effects were previously described as common to all alternatives.

Alternative 5

The plan direction differentiating the effects of alternative 5 from those of the other alternatives are the objectives for upland vegetation treatments, and the relative emphasis placed on fire as the primary restoration tool. The emphasis on fire is much greater than under alternative 2, with alternative 5 containing a standard that restricts the number of acres that can be treated mechanically. As described for the soil and watershed resources analysis, the upland vegetation treatments that are likely to occur under alternative 5 contribute to progress toward desired conditions for some vegetation types and some characteristics, and a net reduction in tree density twice that projected for alternative 2 is likely. This reduces the likelihood of large, contiguous extents of high-severity wildfire. However, similar to alternative 2, the mechanism by which upland tree densities are reduced is fire and substantially more wildfire is used in this alternative. Mechanical treatments are generally restricted to the WUI.

Prescribed fire targeting more difficult acres and allowing for more mixed severity, and more acres being treated with naturally ignited wildfire all increase the likelihood that riparian and aquatic ecosystems will experience the full spectrum of fire and post-fire effects as previously described as common to all alternatives. How this relates to condition and function will be determined by spatial patterns of severity and extent, which cannot be predicted with the vegetation model used for this analysis (see upland vegetation, fire ecology and fuels analysis methodology). On the other hand, riparian areas are far more likely to experience fire and detrimental post-fire watershed responses are far more likely to occur under alternative 5 as opposed to alternative 2.

Alternative 5 includes similar direction for new construction or realignment of roads and other motorized routes, as described for alternatives 2, 3, and 4, but the minimum distance from the riparian zone is increased to 500 feet for riparian zones around perennial streams or native trout-bearing streams. This reduces the detrimental effects of the transportation system, previously described as common to all alternatives, on riparian and aquatic vegetation communities to a greater degree than the other action alternatives for those qualifying areas.

Effects Resulting From Proposed Research Natural Areas

Although RNAs are useful for monitoring climate change impacts (Massie et al. 2016), areas eligible for designation are in good condition, resulting from the predominance of natural processes. They are not in need of restoration treatments, although that would be allowable if it is needed to maintain the characteristics for which they were designated. Treating small populations of noxious weed species, or removing non-native aquatic organisms would be examples of treatments could be needed to maintain the characteristics for which riparian areas were designated. Livestock grazing is not compatible with RNA status.

Of the proposed RNAs within the alternatives, Turkey Creek and Rabbit Trap are the only ones that contain riparian ecosystems, and only Turkey Creek contains aquatic ecosystems. Alternatives 1, 2, and 5 carry forward these proposals. Alternatives 3 and 4 do not. Despite these differences, there are no substantial effects to riparian and aquatic ecosystems associated with any of the proposals at the plan scale due to the small number of acres involved.

However, RNAs are intended to provide opportunities for research. Research can expand the scientific understanding and basis for land management decisions, potentially contributing to better management. On this basis, alternatives 1, 2, and 5 provide the greatest opportunities to advance scientific knowledge and improve riparian and aquatic ecosystem management. Alternatives 3 and 4 provide no such opportunities.

Effects Resulting From Recommended Wilderness Areas

As described under this heading for the soil and watershed resources analysis, plan direction for recommended wilderness areas precludes mechanical treatments, as it does not conform to maintenance of wilderness characteristics. While this has the potential to impact management's ability to move upland vegetation communities and watersheds toward desired conditions, the vegetation modeling results do not suggest mechanical treatments are necessary to move toward desired conditions. However, the model is not spatial and where there are large, contiguous extents with relatively high probabilities of high-severity fire, strategic placement of mechanical treatments can enhance opportunities to manage fire on the landscape in such a way that the post-fire effects help sustain or restore the water, nutrient and sediment regimes that define a given watershed and minimize potential detrimental effects as previously described as common to all alternatives. Without those mechanical treatments, the magnitude of fire and detrimental post-fire effects could increase substantially.

Areas recommended under alternatives 2, 3, and 4 do not contain large, contiguous extents with relatively high probabilities of high-severity fire and are highly unlikely to be priority candidates for mechanical treatments given limitations imposed by their terrain. Their recommendation will not have a substantial effect on management outcomes for riparian and aquatic species as fire is sufficient to maintain or improve watershed conditions. Alternative 5 includes some areas that do have large, contiguous extents with relatively high probabilities of high-severity fire that could be priority candidates for mechanical treatments at some point in the future. Recommendations for these areas restricts management's ability to mitigate future fire and post-fire effects to the associated riparian and/or aquatic ecosystems. Furthermore, these recommendations could also potentially restrict future adaptation options as mechanical equipment may or may not be necessary to restore or maintain riparian or aquatic refugia.

Cumulative Effects

The cumulative effects analysis for soil and watershed resources is directly applicable to riparian and aquatic ecosystems as terrestrial and aquatic processes are integrated within watersheds. They are also part of how watershed conditions are defined. This section expands on that analysis with specificity to riparian and aquatic ecosystems.

Many riparian areas in the Gila NF occur in along streams that pass through other jurisdictions, including other national forests and Federal public lands administered by BLM, and state, municipal and private lands. Most, but not all of these streams originate in the Gila NF or the adjacent Apache-Sitgreaves NFs. Management of the streams themselves and the watersheds containing these streams can have profound beneficial or detrimental effects on riparian and aquatic ecosystems, as previously described, that can either accumulate or attenuate in both the downstream and upstream flow directions (Gori et al. 2014).

The presence of water is a prerequisite for the persistence of riparian and aquatic ecosystems, over which the states have primary control. Arizona recognizes instream water rights, which can provide for ecological flow needs. New Mexico does not. Regardless, more water has been committed to users in the Southwest than is currently available (Phillips et al. 2011). In a drought of the magnitude of the worst 10-year drought on record, water demand may exceed supply by 58 percent (Lenart 2007). With current and predicted future trends in climate, riparian and aquatic ecosystems are highly vulnerable. Given no instream water rights are recognized in New Mexico, that vulnerability is higher than it is in Arizona.

In the Southwest, intense debate will continue over the highest use of limited water, as illustrated by the proposals resulting from the Arizona Water Settlements Act, which approves the consumptive use of an additional 14,000 acre-feet of water from the Gila and/or San Francisco Rivers, their tributaries, and groundwater sources in New Mexico. The Gila and San Francisco Rivers support the most extensive riparian and aquatic ecosystems in the Gila NF and provide habitat to many listed species and species preliminarily identified as being of conservation concern (see wildlife and botanical species). The Arizona Water Settlements Act has polarized communities throughout the New Mexico over water allocation.

Whether driven by drought, use, or both, the area occupied by riparian and aquatic ecosystems in the Gila NF and across the Southwest is likely to shrink and become fragmented, but changes are likely to vary widely from place to place (Smith and Finch 2017). In the Gila NF, drought and current water withdrawals have already altered streamflow patterns and contributed to habitat fragmentation in several important stream systems supporting riparian and aquatic habitats. Those associated with intermittent, interrupted and seasonal water sources, or small water features like springs are likely the most vulnerable. Increased variability of precipitation and more frequent extremes also has implications for the timing of life cycle events dependent on flows of particular magnitudes, which could eventually lead to changes in aquatic community composition (in sensu Gori et al. 2014). Water temperature are likely to increase, creating additional stressors on cold and cool water species, which could also eventually lead to changes in aquatic community composition. For plant species, shorter, warmer winters are also projected to change the timing of life cycle events, like first bud, first flower, and seed set. Combined with changes in water flow, this could lead to fewer and less successful regeneration events for some species and changes in vegetation community composition (Gori et al. 2014; Smith and Finch 2017). Changes in composition that affect a single functional group could lead to declines in function and resilience. Riparian and aquatic ecosystems will become less able to recover from other disturbances, some of which many increase in magnitude and frequency as a result of climate change.

Whether because of not treating enough acres, not treating the right acres, or accepting greater risk with prescribed and naturally ignited wildfire in order to treat more acres, there will be more fire on the landscape. With average fire weather conditions moving toward what are currently considered extreme fire weather conditions, severity distributions are likely to shift toward more mixed- and high-severity fire. This could lead to more frequent and higher magnitude post-fire changes in water, sediment and nutrient regimes. Where vegetation type conversions occur in the uplands, these regimes could be permanently altered, perhaps changing the kind, quality, extent and connectivity of riparian and aquatic ecosystems that a given watershed can support. With more frequent disturbance, non-native invasive and noxious plants will be provided more frequent opportunities to become established and/or spread.

Integrated pest management is being used and will continue to be used to control noxious plants within riparian zones on all jurisdictions, but eradication is likely to remain elusive. The state Departments of Agriculture will continue to provide leadership and technical expertise for this effort, including sponsoring collaborative groups that unite agencies, organizations and individuals in addressing both noxious plant issues and invasive animal species.

Another reasonably foreseeable issue that may be exacerbated by more fire on the landscape, at least on Federal public lands under the multiple use-sustained yield mandate, is the destruction of range infrastructure, particularly fences. Fencing is expensive, and even at current fire frequencies and severities in the Gila NF, it is a financial struggle to repair or reconstruct fire-damaged fences. This could lead to more of what are colloquially called "wild cows." These are self-sustaining, unauthorized, unclaimed, and unmanaged populations of cattle.

In the Gila NF, these populations were initially established not because fire destroyed fences, but because former permittees did not keep up with maintenance or their cattle. Being unmanaged, these now wild cows tend to spend enough time in riparian zones that there are areas that vegetation structure, ecological status and functional diversity, and channel shape and function are moving away from desired conditions, thus reducing resistance and resilience. The Gila NF has been trying to address the wild cow problem for decades now. Attempts to coordinate with the state livestock board, who has jurisdiction over unbranded cattle, will continue. However, it is uncertain as to whether or not the forest will ever gain legal permission to do what is necessary to resolve the problem, which could increase the extent and degree of the damage being done to riparian and aquatic ecosystems over time. Furthermore, maintaining fences is likely to become a larger issue with more fire on the landscape and it is possible that the wild cow problem could become more common on Federal public lands. Whether wild cow or permitted cow, competition between livestock and wildlife for forage and water is likely to increase under future climate, increasing pressure on riparian and aquatic ecosystems.

While the demands and impacts on riparian and aquatic ecosystems are high, and projected to increase, they are some of the most highly valued natural resources and the level of interest in their conservation by agencies, organizations and individuals reflects that. As with other soil and water conservation issues, working together, across jurisdictional boundaries provides for the best possible outcomes and that work continues throughout Arizona and New Mexico.

Herbicide-Use Environmental Consequences

The following discussion of environmental consequences addresses the effects of the herbicide-use alternatives on riparian and aquatic ecosystems.

Analysis Methodology

This is a qualitative analysis supported by the available published literature as cited in the text.

Effects Common to All Herbicide-Use Alternatives

All of the alternatives authorize the use of some herbicides on some number of noxious weeds, including those within the riparian zone. Noxious plants within the riparian zone can indirectly impact aquatic ecosystems and fish habitat. Where they displace native plants, stand structure is changed. This can alter future inputs of wood and leaves that provide the basic foundation for aquatic ecosystem food webs. Native vegetation growth may change as a result of infestation, potentially leading to declines in the quantity and quality of organic matter inputs and aquatic habitat. They can also reduce streambank stability, increase sediment delivery (see also soil and watershed resources effects common to all herbicide-use alternatives) and sometimes water temperature, all of which would lead to declines in aquatic habitat conditions. Changes in the abundance and distribution of native riparian and aquatic plant species can lead to alterations to the abundance and distribution of insect populations, potentially further altering aquatic food webs and riparian and aquatic ecosystem function.

Habitat important to aquatic or riparian-dependent listed species are not substantially threatened by noxious plants at this time, but this could change in the future. Many future climatic predictions are expected to favor non-native, invasive and noxious plant species. Effective noxious plant treatments and restoration of treated sites would improve the function of riparian and aquatic ecosystems, and help reduce the future risk of existing populations expanding.

Hand pulling herbaceous noxious species would cause some ground disturbance and may introduce small amounts of sediment to streams. The presence of people or crews with hand-held tools along streambanks could lead to localized sedimentation and turbidity in fish habitat because of trampling and soil sloughing. However, the amount of sediment generated would be negligible, and turbidity would quickly dissipate.

Herbicides used within the riparian zone have a greater potential to travel to surface or groundwater than in the surrounding uplands due to proximity. However, there is a low risk to aquatic organisms because only those herbicides registered for aquatic use would be allowable in riparian zones and all law, regulation, policy, label instructions, risk assessment and plan direction would support proper selection and use (see appendix K).

All herbicides eventually disappear from inadvertently affected water by dilution, adsorption to bottom sediments, volatilization, absorption by plants and animals, and/or by dissipation. Dissipation refers to the breaking down of an herbicide into simpler chemical compounds. Herbicides can be broken down by sunlight, water, or microbes, plant or animal metabolism. Both dissipation and disappearance are important considerations to the fate of herbicide in the environment. Even if dissipation is slow, disappearance due to processes such as adsorption to bottom sediments makes an herbicide biologically unavailable. For example, glyphosate is not applied directly to water for weed control, but if it makes it into the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive, posing a very low risk to fish, the aquatic food web and habitat. With the design criteria in place, concentrations of herbicides and duration of exposure in aquatic environments would be small and well below levels at which effects are documented for non-plant aquatic organisms.

Effects of Herbicide-Use Alternative A-No Action

See soils and watersheds analysis.

Effects Common to All Herbicide-Use Action Alternatives

See soils and watersheds analysis.

Effects of Herbicide-Use Alternative B-Proposed Action

See soils and watersheds analysis.

Effects of Herbicide-Use Alternative C

See soils and watersheds analysis.

Effects of Herbicide-Use Alternative D

See soils and watersheds analysis.

Cumulative Effects

The cumulative effects described for upland vegetation, fire ecology and fuels, and soils and watersheds are relevant to riparian and aquatic ecosystems. In general, actions taken to improve upland conditions and remove noxious plant species from riparian areas improves habitat for both terrestrial and aquatic species. Most of the jurisdictions that use herbicides are required by law to follow risk-reduction measures, similar to many of those described in this document. Government agencies applying herbicides must meet all acceptable levels of water quality protection. Non-governmental jurisdictions do not typically use large amounts of herbicides. Therefore, there is a low risk of exceeding levels of concern for surface water quality and aquatic ecosystems.

Wildlife and Botanical Species

Affected Environment

Introduction

This analysis evaluates and discloses potential environmental consequences on wildlife and plant resources that may result with adoption of the revised forest plan. The analysis includes terrestrial and aquatic species that are federally listed, bald and golden eagles, Forest Service Sensitive Species, Species of Conservation Concern, and Migratory Bird High Priority Species that may occur or may have habitat within the project area. This section examines, in detail, the existing 1986 forest plan, as amended, and four different alternatives for revising that plan and their effects on wildlife and plant resources.

Wildlife and plant species in the Gila NF contribute to social wellbeing and quality of life by promoting recreational and educational opportunities. The opportunity to hunt, fish, or just commune with nature is a very important tradition for many of the families and communities who live around the forest. Wildlife and plants in the plan area contribute to economic sustainability through employment opportunities, support of small businesses, and Federal receipts shared with local governments.

Terrestrial Habitat

Plant and animal species are highly dependent on the function of ecosystems with specific conditions, such as local soil, air, water, aspect, elevation, precipitation, etc., which create areas favorable for particular species. Vegetation is one of the primary factors that influences species diversity and abundance and is one of the more obvious habitat components influenced by management, land use, and natural disturbance. Species presence and absence on the forest is, in many cases, directly tied to availability, current ecological condition, and key ecosystem characteristics of Ecological Response Units (ERUs).

The proposed action and alternatives, and this analysis utilize the ERU vegetation classification system. ERUs are map unit constructs that combine themes of site potential, historic disturbance regimes and natural succession. Site potential is a term used to describe the characteristic ecological conditions at late development, resulting from the interactions among climate, soil and vegetation. More information about the ERU framework, and the ERUs of the Gila NF can be found in the Upland Vegetation, Fire Ecology and Fuels and Riparian and Aquatic Ecosystems sections of this chapter.

Associating particular ERUs with specific species is critical for assessing future management needs. However, some species utilize features of the landscape that may not be directly tied to ERUs such as caves, mines, cliffs, or talus slopes. There are many species in the Gila NF that use these features and they will be analyzed as specific features needed and not necessarily characteristics associated with specific ERUs. The tables below show the ERUs associated with each species to be analyzed.

Mexican spotted owl, Chiricahua leopard frog, Southwestern willow flycatcher, Gila chub, loachminnow and spikedace have designated critical habitat within the Gila National Forest. Narrow-headed gartersnake, northern Mexican gartersnake, and yellow-billed cuckoo have proposed critical habitat identified within the Gila NF as well. For more details on critical habitat in the forest, see the Designated Areas section.

There are 14 (primary) terrestrial ecological response units in the Gila NF. The 5 forest ERUs make up 1,601,785 acres (approximately 48.5 percent of the Gila), 5 woodland ERUs make up 1,282,507 acres (approximately 28.9 percent), the only shrubland ERU comprises 138,105 acres (approximately 4.2 percent), and the 3 grassland ERUs make up 258,790 acres (approximately 7.8 percent). Nine ERUs are moderately departed, three are highly departed, and two Juniper Grass Woodland and Madrean Piñon-Oak Woodland are in low departure from reference conditions. All ERUs are modelled to be relatively stable with some slight increases and decreases in departure while remaining in the same departure state, except for Juniper Grass Woodland, which is modelled to go from low departure to moderate departure over the 100-year modelling period.

Riparian and Aquatic Habitat

Riparian areas are affected by the presence of surface and subsurface, perennial or intermittent, flowing or standing bodies of water. They are composed of distinctively different vegetative species than adjacent areas where water is more limited. In these systems, terrestrial and aquatic ecological processes are integrated within watersheds. Riparian areas are more productive than other vegetation communities in terms of plant and animal biomass per acre.

Aquatic habitat consists of streams that can be classified as perennial, intermittent or ephemeral by seasonal variations of flow. Ephemeral streams experience relatively short duration flow only in direct response to surface runoff from precipitation or snow melt. Perennial streams typically flow year round as they receive contributions from both surface runoff and groundwater. Intermittent streams fall between perennial and ephemeral types as groundwater contributions are seasonal. Streams, especially perennial and intermittent streams, are important water sources that support terrestrial, riparian and aquatic ecosystems, as well as human uses.

Stream systems and their riparian zones function as important natural corridors for the movement of organisms and materials through landscapes. Movements of species facilitate gene flow on a broad scale, thereby contributing to regional diversity in species and genetic information. The Gila NF contains 12 different riparian ERUs that make up approximately 2 percent of the forest. Wetlands occur in association with some but not all streamside riparian areas (riverine wetlands), as well as in the uplands (non-riverine wetlands). The Gila NF Assessment (2017) identified 2,694 acres of riverine wetlands, 2,534 acres of non-riverine wetlands, 918 spring/seeps, 957 perennial stream miles and 546 intermittent stream miles. Riparian and aquatic ecosystem management have a strong and direct relationship. Additional information on riparian and aquatic habitat can be found in the Riparian and Aquatic Ecosystems section of this document.

Caves, Cliffs, Talus Slopes, and Mines

Caves, cliffs, talus slopes, scree, rock features, and mines are widespread microsites within all vegetation ERUs. These ecological conditions are inherently stable for long periods of time because they are changed primarily by geologic forces. There are a few caves in the Gila NF including one that is managed through access control via a gated entrance and key sign-out procedures. The Gila NF has seen an extensive amount of historic mining with several historic mining districts located within and adjacent to the forest boundary. As such, there are extensive mines and associated mining features (i.e., adits, shafts etc.) located within the forest boundary as well as lands adjacent. Examples of key ecosystem characteristics include cliffs used for nesting by many bird species, cave-like structures and crevices used for roosting and hibernating by many bat species, and rock outcrops or boulder and talus accumulations used by several land snails and plants for all life functions, as well as mammals for hibernation, shelter from the weather, or to escape from predators.

Special Habitat Features

Many species are also associated with fine-scale habitat features that may or may not be captured by the more coarse vegetation community descriptions. Other features important to wildlife and plants include coarse woody debris (e.g., downed logs), rocky riparian areas with deciduous leaf litter, and soil parent material specific to certain plant species. Coarse woody debris provides shelter, food, and moisture retention, and standing snags of sufficient size provide for roosting, nesting, or foraging. These features could impact species if they are departed from reference conditions. These characteristics are somewhat more transient on the landscape and as snags fall down and eventually decay, standing live trees die becoming new snags. If the seral stage proportions of most vegetation communities trend toward smaller-diameter trees, future trees may not be large enough to provide the ecological conditions required by species that depend on large diameter snags.

Plan-Level Environmental Consequences

The following discussion of environmental consequences addresses the effects of the alternatives on wildlife and botanical species that are federally listed, bald and golden eagles, Forest Service Sensitive Species, Species of Conservation Concern, and Migratory Bird High Priority Species in the forest.

Analysis Methodology

Habitat Relationships (coarse-filter, fine-filter)

Under the NFMA (16 U.S.C. 1604(g)(3)(2)), the Forest Service is directed to “provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet multiple-use objectives, and within the multiple-use objectives of a land management plan adopted pursuant to this section [of this Act], provide, where appropriate, to the degree practicable, for steps to be taken to preserve the diversity of tree species similar to that existing in the region controlled by the plan.” To meet this objective, the 2012 Planning Rule adopts a complementary ecosystem and species-specific approach known as a coarse-filter/fine-filter approach to maintaining species diversity (36 CFR 219.9).

Analysis of habitats emphasizes ecological conditions important to wildlife and plants, because many species are strongly tied to individual vegetative types, size classes, and structural characteristics. The analysis presented assumes that species sustainability is best modeled by using what scientific literature designates as typical habitat for a species. A combination of ecosystem (coarse filter) and species-specific (fine filter) conditions are considered and this approach assumes that if the species, genetics, functions, and processes are protected at the community level, then the bulk of the biotic species, both known and unknown, will also be protected. Part of the coarse/fine filter approach also assumes that focusing on the rare species whose persistence is at risk would also provide for diversity of plant and animal communities necessary to meet the diversity requirement of the NFMA. The coarse-filter/fine-filter process is described in detail in the At-risk species section of the Gila NF Assessment Report (USDA FS Gila NF 2017).

Forest plans are developed to guide the maintenance or restoration of structure, function, composition, and connectivity of ecosystems to provide ecological conditions that will maintain a diversity of plant and animal communities and support the persistence of native species in the plan area. This analysis focuses on evaluating the consequences of the plan alternatives on at-risk species. Forest Service at-risk species include two categories: (1) federally designated species and habitat (species listed as threatened or endangered, species that are proposed or candidates for Federal listing, and species with designated critical habitat on the national forests), and (2) Forest Service-designated species of conservation concern (SCC).

Federally Listed Species

This analysis evaluates two primary aspects for federally listed species. First, the adequacy of plan direction in each alternative to protect, maintain, and restore habitat elements identified for species and primary constituent elements of designated critical habitat and to provide for recovery of listed species. Second, the adequacy of plan direction to avoid, minimize, or mitigate potential short-term adverse effects to federally listed species and candidate species, focusing on relevant threats in the Gila NF to individuals within occupied and critical habitat. The analysis also considers the authority of the Forest Service and the inherent capability of the plan area to provide for federally listed species. An analysis for the selected alternative will be documented in detail in a biological assessment to be submitted to the USFWS and available in the project record.

Species of Conservation Concern

The 2012 Planning Rule defines a species of conservation concern (SCC) as: a species, other than a federally listed threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long term in the plan area (36 CFR § 219.9; 77 FR 21169). The Gila NF followed the guidance provided in the directives for the 2012 Planning Rule (Forest Service Handbook [FSH] 1909.12 – Land Management Planning, Chapter 10) in developing this list. More information about the Gila NF SCC selection process can be found in the Gila NF Assessment (2017) that is located on the Gila NF website (link) or available in the project record.

The SCC list guides forest planning. However, the designation of these species is not a forest plan decision. Just as there is a process for the USFWS to change the Federal listing status of a species, the regional forester has authority to change SCC lists to reflect new information.

Ecological Conditions and Quantity

Key indicators for the wildlife species analyses are trends toward reference ecological conditions and habitat quantity. Primary habitat associations and threats are described for each at-risk species. Habitat quantity is evaluated by the potential trend in relative amount and distribution of ecological conditions in the plan area over the next 10 to 15 years. Ecological condition is evaluated by the predicted trend in resiliency and ability of habitats to adapt to large-scale disturbances (such as wildfire, insect outbreaks, and drought).

Alternatives affect overall ecological conditions and move ecological conditions toward the desired state at different rates. These indicators were selected because they provide a reasonable assessment of ecological conditions needed to support the persistence of SCC and because relative differences among alternatives could be readily compared. Qualitative comparisons were used where quantitative data on habitat were unavailable. The amount of habitat provides a relative measure of ecological condition and extent to maintain species persistence and is also an appropriate measure for a programmatic level analysis. Ecological condition is used as an indicator only when it can be adequately determined at the programmatic-level, such as assessing not only the amount of impact from wildfire but also the type of fire and the resulting effects on ecological conditions.

For forest plan revision, management direction that may alleviate or exacerbate threats to ecological condition are evaluated at a programmatic level. The forest plan does not authorize site-specific projects or activities; therefore, there are no direct effects from adopting the forest plan. Direct and indirect site-specific effects will be analyzed when future projects are proposed. Although potential short-term consequences may be described where appropriate from implementing the programmatic approach, this evaluation focuses on longer term indirect and cumulative effects that may occur over the 10- to 15-year life of the forest plan.

Much of the analysis is based upon the premise that the natural range of variation provides important background information for evaluating ecological integrity and sustainability (Weins et al. 2012). The natural range of variation was used in development of plan direction (desired conditions) and selection of indicators and measures for the analysis. This approach was used because the condition and quantity of habitat available to a species helps predict the potential for species distribution and abundance within that ecological condition.

Coarse-filter plan components (largely centered on desired conditions within the natural range of variation) are expected to provide for ecological conditions necessary to maintain the persistence or contribute to the recovery of native species within the plan area. The coarse-filter approach is considered the primary context for evaluating at-risk species. Where coarse-filter components would not provide sufficient conditions for one or more at-risk species, fine-filter (species-specific) plan components, including standards and guidelines, were incorporated.

This analysis includes:

- Departure and trend of key ecosystem characteristics needed by each species and how well plan components address that trend, either toward or away from the desired state.
- How well species' primary threats are addressed and key ecological needs are provided for at the ecosystem level (coarse filter plan components).
- How well species' primary threats are addressed and key ecological needs are provided, which are not already addressed by the above components (i.e., fine-filter components).

Spatial and temporal analysis

In general, the analysis area for environmental consequences includes all lands managed by the Gila NF. However, it may include areas outside the national forest boundary, such as critical habitat adjacent to the planning unit that could be affected by forest management. In some cases, the Gila NF provides all or a high percentage of the ecological condition for a given species. In most instances, wildlife tend to move from area to area, and ecological conditions across multiple land jurisdictions may be important to the overall persistence of the species within its range. Cumulative effects analyses include lands within other ownerships immediately adjacent to the national forest including adjacent Federal land (e.g., other national forest or BLM), and comparatively smaller sections of State and privately owned lands. For species with migratory or travel routes that extend far beyond the Gila NF, management direction under all alternatives would only influence ecological condition (both quantity and condition) within the national forest plan area, as actions that occur outside the Gila NF boundary are not within Forest Service management authority.

The anticipated life of the forest plan is 10 to 15 years. However, because management actions have potential to affect wildlife and plant species and their ecological conditions for many decades, the temporal analysis for modeled vegetation change and cumulative effects discusses changes that may occur over the next 100 years as conditions change and vegetation moves from one successional stage to another.

Assumptions

- 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.
- Conserving species diversity by providing adequate representation (distribution and abundance) of ecological land units considering the historical range of variability based upon an understanding of the natural disturbance regimes of the ecological land units, will likely contribute to their maintenance or enhancement in the future (Haufler et al. 1996). 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 U.S. Fish and Wildlife Service (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.

Existing Designations

Effects to species will continue to be influenced by travel management and existing designations such as RNAs, Wilderness Study Areas (WSAs) and congressionally designated wilderness under all alternatives. All alternatives are consistent with the Travel Management Rule. Under any of the alternatives, forest visitors would continue to follow stipulations regarding cross-country motorized travel. Existing designated areas will continue to pose limitations on modes of access and the use of mechanized equipment for infrastructure maintenance, consistent with the legislation or policy direction that establishes those designations.

Research Natural and Wilderness Study Areas

All alternatives include the Gila River designated Research Natural Area (402 acres), however, the congressionally designated Hell Hole and Lower San Francisco WSAs (18,860 and 8,800 acres, respectively) are both recommended for wilderness designation only under alternative 5, and the Lower San Francisco WSA is recommended for wilderness designation under alternative 4. The 1986 Gila Forest Plan did not recommend either WSA for wilderness designation. However, until such time that Congress acts on final planning recommendations one way or another, the New Mexico Wilderness Act of 1980 and Forest Plan direction mandate that the WSAs be managed to maintain existing wilderness characteristics (see Wilderness Study Area for more details).

Alternative 1 includes one existing designated RNA (Gila River RNA) and four existing proposed RNAs that will be carried forward. The existing proposed RNAs include Turkey Creek, Rabbit Trap, Agua Fria and Largo Mesa. Alternatives 2 and 5 are proposing two of the original four potential RNAs that were proposed during the last planning cycle. The proposals for the Largo Mesa and Agua Fria RNAs are not taken forward because they were found ineligible for the designation (see

Appendix H). Also, many areas identified in the current forest plan are not proposed for RNA designation because they do not qualify for various reasons. Only Turkey Creek and Rabbit Trap proposed RNAs will be carried forward in alternatives 2, and 5 (see Appendix H). Alternatives 3 and 4 contain no recommendations for RNAs.

The RNAs and WSAs would provide areas of habitat connectivity and minimize disturbances to federally listed species through primitive area management as well as having little to no road construction or maintenance. However, management activities to help improve habitat conditions or minimize the possibility of large scale, uncharacteristic fire impacts would not be allowed and the chance for undesirable effects would be increased.

Eligible Wild and Scenic Rivers

An eligibility study was conducted in 2002 that identified 129 miles of eligible wild and scenic river segments. Under the current planning process, a comprehensive evaluation of wild and scenic rivers was conducted. This built upon the previous study, checking these rivers for changed circumstances, as well as including rivers that were not included in the previous study which resulted in approximately 225 miles of eligible wild and scenic river segments identified in the forest that will be analyzed in all alternatives.

The previous and current eligibility studies conducted are only the first two steps in a three step process, and do not constitute a recommendation for designation to Congress. Any rivers recommended for designation would be determined by step three of the process, which is a suitability study. A suitability study will not be undertaken as part of the plan revision process. The forest is obligated to protect, within our authorities, the free flowing nature and outstandingly remarkable values that led to these sections eligibility. Any congressional designation of these wild and scenic river segments would have potentially beneficial impacts of providing habitat connectivity for aquatic species by limiting the types of instream infrastructure and minimizing ground disturbance on terrestrial species that use riparian habitat.

Designated Wilderness and Inventoried Roadless Areas

Designated wilderness (792,585 acres) and inventoried roadless (771,436 acres) areas provide for habitat connectivity and minimize disturbance to federally listed species through managing for wilderness character and roadless characteristics, respectively, as well as having little to no road construction or maintenance. These acreages are the same and apply to all alternatives. Mechanical vegetation management activities to help improve habitat conditions or minimize the possibility of large scale, uncharacteristic fire impacts would not be allowed within designated wilderness, and only with special permission as outlined in the Chief's Review Process for Activities in Roadless Areas (2012), where the chance for undesirable effects would be increased.

Climate Change

Climate change has occurred to some degree and will continue in the future. It is projected to increase the frequency, severity and duration of droughts (IPCC 2007; Seager et al. 2007). Climate change is likely to modify ecological conditions, processes and ecosystem services in many regions and ecosystems (Westerling et al. 2006; Bowman et al. 2009; Flannigan et al. 2009) including the context and plan areas, by altering precipitation patterns, and the timing, quantity, duration and distribution of available water. The effects of climate change could be particularly profound for native fishes and aquatic ecosystems of the Rocky Mountains and Arizona-New Mexico Mountains because those systems often lack resilience and are strongly dependent on temperature and stream flow regimes that are already documented to be changing (Rieman and Isaak 2010). In addition, plants in the arid Southwest already live near their physiological limits for water and temperature stress (Archer and Predick 2008).

Ramifications of a changing climate on federally listed species are likely to include: reduced snowfall or earlier snow melt in the spring, extended periods of drought or extended dry periods in the spring and summer, more frequent and larger wildfires, increased insect- and disease-induced mortality, and changes in site characteristics that promote type conversion or vegetation community changes. These changes cause seasonal ranges and food sources for wildlife to shift and can affect the timing of reproduction. Reduced snowpack and changes in precipitation can affect aquatic species by decreased stream flow and shifts in runoff patterns that could affect spawning success. Forested tracts and remote habitats for all wildlife can also become isolated, reducing landscape connectivity and ecological condition for species with limited dispersal ability. The timing of spring green-up can also affect food availability for migratory birds or forage conditions for big game. Those species with highly specialized ecological condition requirements, at the edge of their range, currently in decline, and/or having poor dispersal abilities may be particularly at risk (National Fish Wildlife and Plants Climate Adaptation Partnership 2012).

Climate change presents an aspect of uncertainty in future conditions, disturbance regimes, and vegetative and wildlife responses. Strategies that can be used to help reduce impacts from climate change include: reducing the risk of large, uncharacteristic fire by managing for resilient native ecosystems, enhance adaptation by anticipating and planning for disturbances from intense storms, increase water conservation and plan for reductions in upland water supplies, avoid management actions that could exacerbate the effects of drought, anticipate increased demand for forest resources, and monitor climate change influences (Triepke 2015). While how well each of the alternatives addresses these strategies varies, it is assumed that to a certain extent, climate change and associated effects to federally listed species would occur under all alternatives. The Climate Vulnerability Assessment for the Gila NF (USDA FS Gila NF 2017) provides additional information on the vulnerability of the different vegetation communities and habitat types to climate change.

Federally Listed Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service under authority of the Endangered Species Act (ESA) of 1973, as amended. Pursuant to Section 7(2)(a) of the ESA, a biological assessment will be prepared to assess the effects of implementing the Gila NF plan proposed action on endangered and threatened species and ensure that proposed actions in the selected alternative would not jeopardize the continued existence of listed species. Table 23 identifies the five federally endangered, seven threatened, and one experimental, non-essential species listed for the four counties (Catron, Grant, Hidalgo, and Sierra) of the Gila NF (USDI FWS 2019). There are no proposed or candidate species listed for the counties of the Gila NF. Only those species that use the forest, have suitable habitat present, and or could be impacted by off-forest management effects (e.g., downstream effects) were fully analyzed.

Table 23. Federally listed threatened or endangered species listed for the four-county area (Catron, Grant, Hidalgo, and Sierra) of the Gila National Forest

Note: An asterisk (*) denotes federally listed species for the Gila NF. Species with no asterisk do not occur within the Gila NF, and would not be impacted by management effects.

Common Name	Scientific Name	Federal Status	Critical Habitat in Gila NF
Amphibians and Reptiles			
Chiricahua leopard frog*	*Lithobates chiricahuensis*	Threatened	Yes
Narrow-headed gartersnake*	*Thamnophis rufipunctatus*	Threatened	Proposed
New Mexican ridge-nosed rattlesnake	*Crotalus willardi obscurus*	Threatened	No
Northern Mexican gartersnake*	*Thamnophis eques megalops*	Threatened	Proposed
Birds			
Least tern	*Sterna antillarum*	Endangered	No
Mexican spotted owl*	*Strix occidentalis lucida*	Threatened	Yes
Northern aplomado falcon	*Falco femoralis septentrionalis*	Experimental population, Non-essential	No
Southwestern willow flycatcher*	*Empidonax traillii extimus*	Endangered	Yes
Sprague's pipit	*Anthus spragueii*	Candidate	No
Western yellow-billed cuckoo*	*Coccyzus americanus occidentalis*	Threatened	Proposed
Fishes			
Beautiful shiner	*Cyprinella formosa*	Threatened	No
Chihuahua chub*	*Gila nigrescens*	Threatened	No
Gila chub*	*Gila intermedia*	Endangered	Yes
Gila topminnow	*Poeciliopsis occidentalis*	Endangered	No
Gila trout*	*Oncorhynchus gilae*	Threatened	No
Loach minnow*	*Tiaroga cobitis*	Endangered	Yes
Rio Grande silvery minnow	*Hybognathus amarus*	Endangered	No
Spikedace*	*Meda fulgida*	Endangered	Yes
Flowering Plants			
Todsen's pennyroyal	*Hedeoma todsenii*	Endangered	No
Zuni fleabane	*Erigeron rhizomatus*	Threatened	No
Mammals			
Mexican Gray wolf*	*Canis lupus baileyi*	Experimental, Non-Essential population	No
Jaguar	*Panthera onca*	Endangered	No
Mexican long-nosed bat	*Leptonycteris nivalis*	Endangered	No
New Mexican meadow jumping mouse*	*Zapus hudsonius luteus*	Endangered	No

Species Status, Key Ecological Conditions and Threats

Amphibians and Reptiles

Chiricahua leopard frog (*Lithobates chiricahuensis*) is federally listed as threatened with approximately 2,488 acres of designated critical habitat in the Gila NF. In New Mexico and in the Gila NF, Chiricahua leopard frogs are thought to be most abundant in the Gila and San Francisco River drainages (Degenhardt et al. 1996), but they also occur in Beaver Creek (tributary to the East Fork Gila River), North Seco Creek, and in the Mimbres River drainage. Chiricahua leopard frogs prefer habitat with a variety of structure and cover, including emergent and submergent vegetation, overhanging banks and organic debris (Degenhardt et al. 1996). Although they can survive drought by burrowing in the mud, they require a perennial source of running or standing water in the form of streams, springs, stock tanks, ponds, or lakes (USDI FWS 2007a). Threats include disease particularly chytrid fungus, reduced water sources, habitat degradation through unauthorized use[w] and recreation or other factors altering hydrologic function, and predation from non-native aquatic species (USDI FWS 2007a).

Narrow-headed gartersnake (*Thamnophis rufipunctatus*) is federally listed as threatened with approximately 52,430 acres of proposed critical habitat in the Gila NF. The New Mexican distribution includes the Gila and San Francisco river drainages in Catron, Grant, and Hidalgo counties, at elevations of 1,125-2,100 meters (Degenhardt et al. 1996, NMDGF 1997 as cited in NatureServe 2016). This species is regarded as one of the most aquatic of all garter snakes (Conant 1963 as cited in NatureServe 2016). It often occurs along well-lit sections of rocky streams with abundant riparian vegetation. In New Mexico, it feeds exclusively on fishes (NMDGF 1985 as cited in NatureServe 2016). Threats include direct predation from non-native aquatic species, competition by non-native fish, and loss of riparian habitat through unauthorized use and recreation.

Northern Mexican gartersnake (*Thamnophis eques megalops*) is federally listed as threatened with approximately 8,717 acres of proposed critical habitat in the Gila NF. In New Mexico, this snake is known from the lower Gila River basin, along Duck and Mule creeks in Grant County and near Virden in Hidalgo County (Hubbard and Eley 1985 as cited in NatureServe 2016). It may now be eliminated from Duck Creek (NMDGF 1997 as cited in NatureServe 2016). A record from a single locality along Mule Creek is the only recent evidence of the presence of this species in New Mexico, but the current status of that population is unknown (Center for Biological Diversity 2003 as cited in NatureServe2016). This snake is strongly associated with permanent water with vegetation, including stock tanks, ponds, lakes, cienegas, cienega streams, and riparian woods (Degenhardt et al. 1996, Manjarrez 1998). The diet includes fishes, amphibians, earthworms, leeches, and various other small animals (NatureServe 2016). Threats include loss of streams, wetlands, and riparian zones through unauthorized use, water diversions, decline of native fish, and predation/competition from non-native aquatic species.

Birds

Mexican spotted owl (*Strix occidentalis lucida*) is federally listed as threatened with designated critical habitat in the Gila NF of which there is approximately 1,122,802 acres. The Mexican spotted owl (MSO) inhabits mixed coniferous and pine/oak forests, canyons, desert caves, cliff faces, and riparian areas throughout the Southwest. In the Gila NF, mixed conifer and pine-oak habitat is considered either protected or recovery habitat in the recovery plan for this species. Protected habitat

[w] Unauthorized use occurs when it has been determined that grazing is not compatible with achievement of desired conditions (range suitability determination made at the project level).

are Protected Activity Centers (PACs), and unoccupied mixed conifer and pine-oak is considered recovery habitat (USDI FWS 2012). Many timber management activities negatively affected habitat before the MSO was listed as threatened in 1995. Timber harvest, prescribed burning, and other management activities are now designed following the 2012 Mexican Spotted Owl Recovery Plan along with consultation with the USFWS. These management activities can still have disturbance affects to the Mexican spotted owl and its habitat. Threats include habitat loss due to historical silvicultural treatments, uncharacteristic wildfire, and increased human activities in proximity to nest/roost territories.

Southwestern willow flycatcher (*Empidonax traillii extimus*) is federally listed as endangered with approximately 1,547 acres of designated critical habitat in the Gila NF. The species has been documented in the Gila and San Francisco River drainages. Habitat includes riparian and wetland thickets, generally of willow, tamarisk, or both, sometimes boxelder or Russian olive (USDI FWS 2013). In the Gila NF, two sites have been consistently occupied for over 10 years along the Gila River. These two areas are in locations known as the Gila Bird Management Area and the Fort West ditch site. In 2008, seven territories were found at the Gila Bird Management Area and four territories at the Fort West ditch site (Shook 2009). In 2007, a new breeding site was discovered in the forest along the San Francisco River (Keller Canyon site). The Keller Canyon site, located on the reach between Deep Creek and Alma Highway 180, had three flycatcher territories in 2007, 2008, and 2009. Threats include loss of riparian habitat from floods, unauthorized use, uncharacteristic fire, nest parasitism, and unmanaged recreation.

Yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is federally listed as threatened with approximately 1,680 acres of proposed critical habitat in the Gila NF. The western population of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*), an insect-eating bird found in riparian woodland habitats, winters in South America and breeds in western North America (USDI FWS 2014). In the Gila NF it is found in the Gila and San Francisco River drainages. Threats include loss or degradation of riparian habitat, agriculture, water diversions, unauthorized use, uncharacteristic wildfire, and non-native plant invasion, particularly tamarisk (USDI FWS 2014).

Fish

Chihuahua chub (*Gila nigrescens*) is federally listed as threatened with no designated critical habitat in the Gila NF. Chihuahua chub is native to the Mimbres River drainage in New Mexico and the Guzmán and Laguna Bustillos basins in Chihuahua (Smith and Miller 1986). Specimens were first collected in the Mimbres River in 1851 (Baird and Girard 1853), but it was not again found in the Mimbres River drainage until 1975 when Rogers (1975) found a small, reproducing population in Moreno Spring. Chihuahua chub probably occupied all warmwater reaches in the Mimbres River drainage, but they now are found regularly only in Moreno Spring. They irregularly occur in about a 9.3-mile reach of the Mimbres River from the confluence of Allie Canyon downstream to the New Mexico Department of Game and Fish Mimbres Property south of Mimbres (Propst 1999). Ash-laden flows from wildfires have reduced Chihuahua chub abundance in the Mimbres River (Myers 2016). Threats include changes in flow regimes and stream characteristics from uncharacteristic fire in the uplands, unauthorized use, agricultural, water diversions, and competition/predation by non-native aquatic species.

Gila chub (*Gila intermedia*) is federally listed as endangered with approximately 764 acres of designated critical habitat in the Gila NF. Gila chub have been recorded in approximately 43 rivers, streams, and spring-fed tributaries throughout the Gila River basin in southwestern New Mexico, central and southeastern Arizona, and Northern Sonora, Mexico (Miller and Lowe 1967; Minckley

1973; Rinne 1976; DeMarais 1986; Bestgen and Propst 1989). Gila chub commonly inhabit pools in smaller streams, springs, and cienegas (a desert wetland), and can survive in small artificial impoundments, such as man-made ponds (Miller 1945; Minckley 1973; Rinne 1975). Gila chub are highly secretive, preferring quiet, deeper waters, especially pools, or remaining near cover including terrestrial vegetation, boulders, and fallen logs (Minckley 1973). Threats include changes in flow regimes and stream characteristics from uncharacteristic fire in the uplands, unauthorized use, and competition/predation by non-native fish species.

Gila trout (*Oncorhynchus gilae*) is federally listed as threatened with no designated critical habitat in the Gila NF. Historically, Gila trout was native to the Gila River drainage (including the San Francisco) in New Mexico and the Verde River drainage in Arizona (Miller 1950; 1972; Minckley 1973; Behnke 1992). Gila trout is found in moderate- to high-gradient perennial mountain streams above 1,660 meters (5,400 feet) elevation. Streams typically flow through narrow, steep-sided canyons and valleys. Abundant invertebrate prey, cover, and water free from contaminants are also required. Cover typically consists of undercut banks, large woody debris, deep pools, exposed root masses of trees at water's edge, and overhanging vegetation (USDI FWS 2003). A great deal of time and effort has been invested in Gila trout restoration in the Gila NF. Many streams have been cleaned out of non-native species using piscicide, while other streams have had non-native species eradicated by ash flows from wildfire, and Gila trout have been repatriated into those streams. Threats include changes in flow regimes and stream characteristics from uncharacteristic fire in the uplands, unauthorized use, and competition/predation/hybridization by non-native salmonid species.

Loach minnow (*Tiaroga cobitis*) is federally listed as endangered with approximately 11,673 acres of designated critical habitat in the Gila NF. The loach minnow is endemic to the upper Gila River drainage of southwestern New Mexico, southeastern and east-central Arizona, and northeastern Sonora (Miller and Winn 1951; Koster 1957; Minckley 1973). The minnow was found throughout the San Francisco and Gila rivers in New Mexico, as well as lower elevation reaches of several tributaries (Koster 1957; Propst et al. 1988). Loach minnows are now restricted to the following areas: portions of the Gila River and its tributaries, the West, Middle, and East Fork Gila River (Grant, Catron, and Hidalgo counties, New Mexico); San Francisco and Tularosa rivers and their tributaries, Negrito and Whitewater creeks (Catron County, New Mexico); Blue River and its tributaries, Dry Blue, Campbell Blue, Pace, and Frieborn creeks (Greenlee County, Arizona, and Catron County, New Mexico) (NatureServe 2016). Loach minnows persist mainly in streams having relatively natural flow regimes and a predominance of native species (Propst and Bestgen 1991). Recurrent flooding is important in keeping substrate free of sediments and in helping this species maintain a competitive edge over invading non-native fishes (NatureServe 2015). Threats include changes in flow regimes and stream characteristics from uncharacteristic fire in the uplands, unauthorized use, and competition/predation by non-native fish species.

Spikedace (*Meda fulgida*) is federally listed as endangered with approximately 9,968 acres of designated critical habitat in the Gila NF. The spikedace is endemic to the Gila River drainage of southwestern New Mexico and southeastern and central Arizona, and perhaps northern-most Sonora (Koster 1957; Minckley 1973; Miller and Winn 1951). In New Mexico, spikedace was moderately common to abundant in the San Francisco River, the mainstem Gila River, and lower reaches of the three forks of the Gila River (Anderson 1978; Propst and Bestgen 1986). Spikedace have been extirpated from the San Francisco River (Anderson 1978; Propst and Bestgen 1986), but have been reintroduced and appear to be established (Paroz 2016). The spikedace has a discontinuous distribution in the Gila River in New Mexico. It has historically been irregularly collected in low numbers in the East Fork Gila River although they have not been found there since the 1980s

(Paroz 2016), regularly collected, but in declining numbers, in the West Fork Gila River, and may be extirpated from the Middle Fork Gila River (Propst and Bestgen 1986; NMDGF unpublished data as cited by NatureServe 2016). The Cliff-Gila Valley as recently as the mid-1980s supported the largest New Mexico population of spikedace (Propst and Bestgen 1986), but its abundance there declined considerably in the late 1990s (NMDGF unpublished data as cited by NatureServe 2016). Threats include changes in flow regimes and stream characteristics from uncharacteristic fire in the uplands, unauthorized use, and competition/predation by non-native fish species.

Mammals

Mexican gray wolf (*Canis lupus baileyi*) is federally listed as an experimental, non-essential population in the Gila NF. Mexican gray wolves are the southernmost occurring (Nowak 1995 and 2003 as cited in Mexican Wolf Blue Range Adaptive Management Oversight Committee and Interagency Field Team 2005), rarest, and most genetically distinct gray wolf in North America (Garcia-Moreno et al. 1996). Historically the Mexican gray wolf primarily inhabited forested, mountainous terrain. The wolf does not require specific vegetation, however it reportedly most often occurred above 4,500 feet elevation in or near pine, oak, or piñon-juniper woodlands, interspersed with grassland. They occurred in the mountainous regions of the Southwest from throughout portions of southern Arizona, New Mexico, and Texas into central Mexico (NatureServe 2016). Mexican gray wolves were extirpated in the United States by aggressive predator control programs. Mexican gray wolves were reintroduced into the Blue Range Wolf Recovery Area within the Apache-Sitgreaves National Forests in Arizona in March 1998 (USFWS Mexican Wolf Recovery Program website https://www.fws.gov/southwest/es/mexicanwolf/BRWRP_home.cfm). In March 2000, Mexican gray wolves were translocated into the Gila Wilderness. At the end of April 2016, the wild Mexican wolf population consisted of 53 wolves with functional radio collars dispersed among 19 packs and two single wolves. The reintroduced wolves are classified as a "nonessential, experimental" population. Threats include in-breeding and human harassment.

New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) is federally listed as endangered and has only recently (summer 2018) been found in the Gila NF in a portion of Dry Blue Creek adjacent to the Arizona border. The New Mexico meadow jumping mouse has exceptionally specialized habitat requirements to support these life history needs and maintain adequate population sizes. Habitat requirements are characterized by tall (averaging at least 61 cm (24 in)), dense riparian herbaceous vegetation (plants with no woody tissue) primarily composed of sedges (plants in the Cyperaceae Family that superficially resemble grasses but usually have triangular stems) and forbs (broad-leafed herbaceous plants). This suitable habitat is only found when wetland vegetation achieves full growth potential associated with seasonally available or perennial flowing water (USFWS 2014). Since 2005, there have been 29 documented remaining populations spread across the eight geographic management areas (2 in Colorado, 15 in New Mexico, and 12 in Arizona). Nearly all of the current populations are isolated and widely separated, and all of the 29 populations located since 2005 have patches of suitable habitat that are too small to support resilient populations of New Mexico meadow jumping mice. In addition, 11 of the 29 populations documented since 2005 have been substantially compromised since 2011 (due to water shortages, excessive grazing, or wildfire and postfire flooding), and these populations could already be extirpated. Seven additional populations in Arizona may also be compromised due to post-fire flooding following a large recent wildfire (USFWS 2014). Similarly, the population at Sugarite Canyon State Park has been significantly impacted since the 2011 Track Wildfire (Frey and Kopp 2013 as cited in USFWS 2014). At this rate of population extirpation (based on known historical population losses and possible recent population losses) the probability of persistence of the subspecies as a whole is severely compromised in the near term (USFWS 2013).

Environmental Consequences Common to Federally Listed Species for All Alternatives

Effects of probable management activities that could potentially affect wildlife communities can be grouped into three broad categories: (1) changes in the type, quantity, quality, and spatial arrangement of suitable ecological conditions; (2) direct mortality, reduced survival, or increased susceptibility to mortality; and (3) increased disturbance.

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 were added as needed. Appendix D lists the forest-wide plan components that would apply to at-risk wildlife, plant, and aquatic species (including federally listed species) under all action alternatives. Two of the action alternatives (2 and 5) have additional proposed botanical management area plan components or objectives which are described in their individual sections. The following analysis applies to plan components shared in common.

All five alternatives would use mechanical vegetation treatment and wildfire to varying degrees to manage all upland ERUs, and mechanical vegetation treatment or structural improvement to manage riparian/water resources (e.g., aquatics, riparian ERUs) to improve ecological condition, abundance, and distribution for species that depend on those vegetation communities. Depending on the alternative, the acreage difference varies as well as the ERUs in which the activities would take place. These systems have varying departure ratings (low to high) from reference conditions. Any of these activities has the potential to modify habitat and create a disturbance for listed species, but all activities in the alternatives would move ecological conditions closer to desired conditions. This would improve the ecological conditions for listed species increasing resilience of ERUs to uncharacteristic disturbances and improving the likelihood of long-term persistence and viability. Current science demonstrates the positive benefits that forest fuel-reduction treatments can have in terms of improving resiliency in frequent fire-adapted systems of the west/southwest (Stephens et al. 2012).

The primary needs for threatened and endangered species are addressed through law, regulation, and policy (such as recovery plans and conservation agreements) which are incorporated by reference. The forest plan provides the framework for implementing the recommendations from these higher-level laws, regulations, policies, plans, and agreements for these species, with limited needed additional direction. Some species listed threats are "unauthorized use," which is the same as unmanaged grazing, and is not legal in the Gila NF. These instances are covered under existing law and policy, and no plan components were developed to address illegal activities on the forest. There are plan components that address grazing and ensuring it is in balance and compatible with other forest uses (Livestock Grazing DC 3, STD 1).

Federally listed species in the Gila NF typically use forests from Ponderosa Pine Forest to Mixed Conifer with Aspen ERUs, riparian ERUs, and aquatic systems. The primary contemporary threat is loss of habitat related to large stand-replacing fire, associated run off and sedimentation that could affect riparian habitat, and altered in-stream flow. All alternatives would move habitat for these species toward the desired state but vary in magnitude, intensity, and location of treatments. There could be some localized adverse impacts to these species, but overall species viability would be maintained. Objectives to treat acres in these ERUs would move them toward a vegetative or aquatic state that species have adapted to that is within the natural range of variability by increasing the amount of habitat in the desired seral states or properly functioning condition for breeding, roosting, and foraging.

The USFWS lists the New Mexican ridge-nosed rattlesnake, least tern, northern aplomado falcon, Sprague's pipit, beautiful shiner, Gila topminnow, Rio Grande silvery minnow, Todsen's pennyroyal, Zuni fleabane, jaguar, and Mexican long-nosed bat for Catron, Grant, Hidalgo, and Sierra counties, but their range within these counties does not include the Gila NF (Degenhardt et al. 1996, USDI FWS 2019) and would not be impacted by off-forest management effects. As such there is no effect to these species or their critical habitat from any of the alternatives.

Conservation Measures

Risk to species viability is reduced by provisions in existing law and policy. For all alternatives, the Gila NF would continue to follow the intent of all recovery plans for federally listed species even if actions within those plans do not match the forest's desired conditions for the particular resource area. These include specific consideration of effects to federally listed species (proposed, threatened, and endangered species) in biological assessments conducted as part of all national forest management decisions. These assessments identify where additional protective measures are warranted to provide for continued existence of the species on NFS land. Projects that may affect federally listed or proposed species must be coordinated with the USFWS during the project planning stage to mitigate potential impacts to listed species under Section 7(a) (2) of the ESA. In addition, section 7(a) (1) of the ESA directs Federal agencies to use their authorities to carry out programs for conserving threatened and endangered species. The forest currently fulfills this duty as described below.

<u>Chiricahua leopard frog (CLF)</u>

- Amend the Land and Resource Management Plan (LRMP) standards and guidelines for riparian inventory and management, which included fencing livestock out of riparian areas. Livestock grazing and native fish restoration projects consider recovery goals of the CLF. Livestock use in occupied CLF watersheds maintains or promotes satisfactory watershed condition such that the effects of livestock in the watershed do not alter flow regimes, accelerate erosion and sediment transport into occupied sites.
- Partner with USFWS and Ladder Ranch to create steel rim tank refugia for Chiricahua leopard frogs in an attempt to mitigate losses of CLF populations. This provides a place to keep frogs that are chytrid free or at least prevent them from spreading chytrid to native populations.
- Monitor all known CLF populations in the Gila NF, as well as survey prior to any project decision or implementation.
- Wildfire suppression and fire use projects are designed to incorporate protective measures and best management practices for watersheds where the CLF occurs.

<u>Mexican spotted owl (MSO)</u>

- The forest surveys for owls prior to the implementation of projects. If breeding owls are detected, protected activity centers (PACs) are established according to the most current recovery plan recommendations.
- Manage the forest to allow fire to return as a natural process. Natural fires burning at typical historical intensities are allowed to burn with the objective of reducing the risk of future high-

severity and high-intensity fires that are believed to be outside the historical range of variation. This objective addresses one of the greatest current threats to the MSO.

- Monitor protected activity centers and provide USFWS with monitoring and project survey results annually.
- Support new, broad-scale, population monitoring efforts as defined by the Revised MSO Recovery Plan (USDI FWS 2012).

Southwestern willow flycatcher (SWWF)

- GeoMarine Inc. and other contractors have done surveys in the Gila NF (San Francisco, upper Gila River, Whitewater Creek), and in 2007 the data indicated that four additional pairs have been documented in the area (three on NFS lands, and one adjacent to the forest).
- Where habitat for this species exists in the Gila NF, the forest has managed the habitat to provide the highest number of SWWF possible.
- Work with the Forest Service research station and Western New Mexico University to monitor SWWF sites in the forest. Also, the San Francisco River was fenced off from livestock grazing several years ago to comply with a Range National Environmental Policy Act (NEPA) decision on the Cedar Breaks Allotment.
- Excluded livestock grazing from large portions of the San Francisco and Gila Rivers to improve riparian function. The forest has also developed wetlands at the Gila River Bird Management Area. The Gila River Bird Management Area is also closed to off-highway vehicle (OHV) use.

Chihuahua chub

- Conduct annual monitoring with partners at The Nature Conservancy and New Mexico Department of Game and Fish (NMDGF) occupied sites, and the forest assists NMDGF with supplemental stockings at these two sites.
- Implemented grazing management plans that exclude livestock from Mimbres River including the occupied site near Cooney Canyon and upstream, and along McKnight Creek where unsuccessful stockings of Chihuahua chub occurred.
- Cooperate with NMDGF and University of New Mexico to collect tissue samples from all occupied sites along the Mimbres River for genetic analysis, and during this effort chub were collected and transferred to Dexter National Fish Hatchery to supplement the existing brood stock.
- Developed a conservation agreement with the New Mexico State Engineer to allow water rights owned by the Forest Service to act as in-stream flow for the protection of Chihuahua chub within the Mimbres Valley. The conservation agreement allows additional parties to place water rights into the agreement on an annual basis, and the water is then unavailable for other uses (i.e., irrigation) for that year.

Gila chub

- Provided funding to Dr. Thomas E Dowling, University of Arizona, to initiate genetic work on the phylogenetically unresolved complex of chubs in the Gila River.
- Cooperated with NMDGF to survey and evaluate streams in the San Francisco River Basin of New Mexico for Gila chub presence, and to determine streams for possible repatriation.

- Cooperated with NMDGF to begin survey and inventory efforts on San Francisco River tributaries to determine suitability for Gila chub introductions.
- Monitor the Turkey Creek population including habitat conditions, and determined that Gila chub are present, reproducing and recruitment is occurring (Gila NF 2010 unpubl. data).

Gila trout

- Forest Service, NMDGF, and USFWS personnel have partnered to translocate and supplement existing populations by stocking throughout several tributaries and creeks in the forest. New populations have been created on the forest.
- Cooperate with NMDGF and USFWS to completed piscicide treatments on the Upper West Fork Renovation Project.
- Undertook development and completion of a Supplement to the existing Environmental Analysis to allow the use of rotenone in place of antimycin for implementing piscicide treatments.
- Partnered with NMDGF and USFWS personnel to collect Gila trout from Spruce Creek and transported to Mora National Fish Hatchery for brood stock development.
- Monitor multiple populations throughout the forest annually.
- Conducted several evacuations of Gila trout that were in the path of wildfires, which were subsequently transported to Mora National Fish Hatchery for rearing and release post-fire.
- Removal efforts have been conducted to remove non-native trout from the occupied Gila trout reaches of multiple streams.
- Engineering design and environmental compliance was completed for a new barrier in Black Canyon.

Loach minnow

- Annually partner to complete monitoring at eight long-term monitoring sites located in loach minnow habitat in the forest.
- Partnered to initiate a 4-year project to determine the efficiency of and effects on native and non-native fish communities of mechanically removing non-native fish along 3 miles of the West Fork Gila River.
- Cooperated with NMDGF, Arizona Game and Fish Department (AGFD), and USFWS Phoenix Ecological Services (ES) Office to collect loach minnow from the main stem Gila River for captive breeding at the Bubbling Ponds Hatchery.

Spikedace

- Annually partner to complete monitoring at five long-term monitoring sites located in spikedace habitat in the forest.
- Partnered to initiate a 4-year project to determine the efficiency of and effects on native and non-native fish communities of mechanically removing non-native fish along 3 miles of the West Fork Gila River.
- Cooperated with NMDGF, AGFD, and USFWS Phoenix ES Office to collect spikedace from the main stem Gila River for captive breeding at the Bubbling Ponds Hatchery.

Mexican gray wolf

- Employ a full time Mexican wolf liaison who works with the ranger districts and Forest Service livestock permittees to find solutions to wolf/livestock conflicts.
- Work to improve communications with the interagency field team and coordination with the Mexican wolf project.
- Work with the Forest Service livestock permittees to explain the role of the agency in the Mexican wolf reintroduction program, to recommend and support proactive management measures, and to provide logistical support to the interagency field team.
- Participate in the annual helicopter count and capture by providing permittees with information, helping with making contact prior to helicopter operations, and helping gather wolf sighting information, while providing logistical support that improves the quality of the annual count of Mexican wolves.
- Work with Forest Service range permittees who have denning wolves on their allotments, to change livestock management and pasture rotations to reduce the potential for wolf/livestock conflicts.
- Work to provide funding for range riders for permittees who have conflicts with wolves.
- Coordinate with USFWS and the interagency field team on translocation proposals and implementation.
- Completed NEPA on 10 release sites, met with permittees and local communities to discuss proposals, and coordinated with the interagency field team on planning and implementation. Authorized the use of temporary pens in additional locations to facilitate goals of the Mexican wolf project.
- Coordinate with the interagency field team on the management of prescribed fires and wildfires to avoid impacts to denning or rendezvous sites.

Environmental Consequences for Federally Listed Species – Alternative 1

Forest plans are permissive unless they expressly prohibit activities. The lack of detailed desired conditions and other plan components means that there is more potential variation in outcomes under the current plan, even if it is amended. The current 1986 forest plan, as amended, would have impacts to Mexican spotted owl, southwestern willow flycatcher, western yellow-billed cuckoo, Chiricahua leopard frog, northern Mexican garter snake, narrow-headed garter snake, Chihuahua chub, Gila chub, Gila trout, loach minnow, spikedace, and New Mexico meadow jumping mouse, and critical or proposed critical habitat for all but Chihuahua chub and Gila trout, as it has not been designated for these species. Also, there would likely be impacts to Mexican gray wolf, but as a non-essential experimental 10(j) population impacts would not rise to the level of jeopardizing the species. Because the current forest plan was not explicitly developed using the coarse-filter, fine-filter approach (a key tenet of the species diversity requirements under the 2012 rule), alternative 1 would be largely limited to plan direction from the 1996 Amendment, and BMPs and site specific mitigations done at the project level. While plan components may not have been explicitly developed for all aspects of species habitat (e.g., MSO seral state needs), they were still addressed through implementation of BMPs or through following requirements listed in recovery plans or through site-specific project design. All federally listed species require evaluation of site-specific projects to determine if consultation with the USFWS is appropriate.

The current forest plan, including amendments, has numerous standards and guidelines that require the evaluation and protection of federally listed species. These were evaluated in the Biological Assessment for the Continued Implementation of the Land and Resource Management Plans (LRMP) for the Eleven National Forests and National Grasslands of the Southwestern Region (USDA FS 2011), LRMP Reinitiation for new species listings for the western yellow-billed cuckoo, Northern Mexican garter snake, and narrow-headed garter snake (USDA FS 2015a), and the resulting 2012 Programmatic Biological Opinion (herein after referred to as 2012 BO) (USDI FWS 2012). Determinations have been made for these species in these prior consultations (incorporated above by reference) and will be the same for this alternative. Many of the standards and guidelines that have the potential to benefit wildlife in the current forest plan are also found in the action alternatives being evaluated in this DEIS in the form of desired conditions, standards, guidelines, or management approaches. In many places, the current forest plan reiterates existing law, regulation, or policy, but these are incorporated by reference in the action alternatives and are considered more specifically at the project level. An issue with the current forest plan is that the 1996 Plan Amendment incorporated many parts of the 1995 MSO Recovery Plan as part of the forest plan. This essentially hardwired the recovery plan to the forest plan. When the MSO recovery plan was updated in 2012, the forest was bound to the 1995 Recovery Plan, as it was part of the current forest plan and would require a plan amendment to follow recommendations of the 2012 MSO Recovery Plan.

Alternative 1 (no-action alternative) is to continue using the 1986 forest plan including all associated amendments, which is the combination of using naturally ignited wildfire, prescribed fire and mechanical treatments or thinning treatments. Prescriptive (restrictive) standards and guidelines in the current forest plan make it difficult to apply adaptive management, as our understanding about management effects on ecosystems and wildlife changes. Adaptive management will be essential to effectively manage for climate change or any other changes in management that may be needed through changing and uncertain conditions, or with new and better scientific information. Current direction for invasive species is primarily focused on noxious weeds. Climate change has the potential to affect all wildlife and plant species, and influences the likelihood of large-scale disturbance (e.g., fire, bark beetle outbreaks) across the landscape. Alternative 1 does not recognize climate change impacts to species and offers limited guidance associated with management activities (e.g., salvage logging, blow down) related to such disturbance events. Guidance for salvage operations is general in nature and focuses more on the enhancement of timber production rather than an integrated approach that balances management with other resource values such as wildlife habitat. The forest would continue to follow existing law, regulation, policy and best management practices to address species viability concerns in areas affected by large-scale disturbance.

There is no recommended wilderness and both wilderness study areas are not recommended for wilderness designation under alternative 1.

Chiricahua leopard frog, Narrow-headed garter snake, and Northern Mexican garter snake

Key Ecological Conditions: Variety of structure and cover, emergent or submergent vegetation, abundant riparian vegetation, overhanging banks, rocky streams, permanent water

Key Threats: Disease, particularly Chytrid, reduced water sources, predation/competition by non-native aquatic species, altered hydrologic function from unauthorized use and recreation (no components developed for illegal activities), water diversions (none planned by the Gila NF), decline of native fish.

Chiricahua leopard frog was analyzed in the Continued Implementation of the Land and Resource Management Plans (LRMP) for the Eleven National Forests and National Grasslands of the Southwestern Region (USDA FS 2011) with USFWS providing a BO in 2012, but the two garter snakes were not listed until 2014 with proposed critical habitat identified. The gartersnakes were then analyzed in a BA and sent to USFWS for Reinitiation of Consultation for the LRMP in 2015 along with western yellow-billed cuckoo.

All three of these species and their designated or proposed critical habitat is protected by standards and guidelines (S&Gs) included in Amendment No. 10-Inventory and Management of Riparian Areas which has S&Gs related to all. It was determined that all of the S&Gs would be beneficial to the CLF in the 2012 BO. S&Gs brought forward for consideration are (1) develop action plans that identify strategies for achieving satisfactory riparian conditions, (2) Maintain riparian ecosystems currently in satisfactory condition, and (3) Prevent any new noxious or invasive weed species from becoming established, contain or control the spread of known weed species, and eradicate species that are most invasive and pose the greatest threat to biological diversity and watershed condition. While not a standard or guideline, there is guidance in place that requires decontamination procedures when conducting work in water courses to minimize or eliminate the potential transfer of Chytrid as well as non-native invasive species. There are plan components in the existing plan that discuss favoring native species, but nothing that directs us to remove any non-native aquatics. However, projects have been proposed and implemented to remove non-native aquatic species that could prey upon or compete against these species. Work has been done forest-wide to augment native fish species in streams with struggling populations, as well as in streams that have had fish extirpated due to ash flows post wildfire. This has all been done through project-level decisions. In addition, the Forest Service and the USFWS jointly developed a set of conservation measures for the CLF, which became part of the proposed action under the 2011 consultation and have been implemented by the forest.

According to the 2012 BO, while implementation of conservation measures and S&Gs from Amendment No. 10 has reduced effects to the CLF in the forest, and should go a long way toward recovery of CLF populations. These same conservation measures and S&Gs should also help to minimize impacts to the gartersnakes and aid in their recovery as well. Projects and program activities implemented under the current forest plan still may occur near or within occupied, designated, or proposed critical habitat in the Gila NF.

Although habitat is managed for improved riparian conditions in order to maintain viability in the forest, activities may be permitted, authorized, or funded, which may negatively affect individuals or affect designated or proposed critical habitat. While some individuals of these species may be impacted, management activities for this alternative would not adversely affect the viability of the species and overall viability would be maintained.

Mexican spotted owl

<u>Key Ecological Conditions:</u> Mixed coniferous and pine/oak forests, canyons, desert caves, cliff faces, and riparian areas. Forested habitat is typically uneven-aged, multi-storied, and has high canopy closure.

<u>Key Threats:</u> Habitat loss due to historical even-aged silvicultural treatments, uncharacteristic wildfire, and increased human activities in proximity to nest/roost territories (PACs).

Mexican spotted owl (MSO) and its designated critical habitat is protected by the standards and guidelines included in the 1996 plan amendment (1986 forest plan, as amended). Projects and program activities implemented under the current forest plan may occur near or within MSO protected activity centers and within critical habitat. While the standards and guidelines provide protection for the owl and maintain their viability on the forest, activities may be permitted, authorized, or funded, which may negatively affect individuals or affect designated critical habitat over the short term. Direction for the owl and its habitat in the current forest plan directly incorporates guidance from the 1995 Recovery Plan. This guidance is no longer current and at times is in conflict with newer direction and/or direction for other species such as northern goshawk. MSO guidance would take precedence over other species in protected and restricted areas and recommendations outlined in the Revised Recovery Plan (USDI FWS 2012) would be followed. The Revised Recovery Plan recognizes large, stand-replacing wildland fire as the greatest risk to the species' persistence and encourages the use of fire and vegetation management as a restoration approach. This thinking has changed since the 1995 Recovery Plan was originally written where it was thought that silvicultural treatments and their continuation described in current forest plans were the primary threats listed. The 1996 plan amendment changed the way silvicultural treatments were planned and for the most part eliminated the treatments that were considered a threat to MSO habitat. The trend toward forest visitation at the time of the 1995 MSO Recovery Plan was that there were more people recreating in the forest through camping or hiking trips. This was the basis of listing increased human influences in proximity to nest/roost habitat. Across the forest, visitation has fluctuated over the years according to the National Visitor Use Monitoring (NVUM) surveys. However, it isn't possible to know if public visitation through camping or hiking through MSO PACs has increased. The 1996 plan amendment addresses this for any Federal activities and provides breeding season restrictions for any activities within PACs. The Gila NF will continue to incorporate appropriate conservation actions. See the ESA section 7(a) (1) discussion above in the Effects Similar for All Alternatives for actions the forest continues to take to mitigate risk to the owl.

According to the (2012) BO, the overall assessment of the 1986 forest plan, as amended, was that the plan has a considerable amount of positive guidance for listed species and will not appreciably impact MSO or its critical habitat. The assessment also found that forest management actions (current silvicultural treatments) should increase the sustainability and resiliency of MSO habitat, particularly through fuels management and forest restoration actions, and that continued implementation of the 1986 forest plan, as amended, is not expected to further diminish the conservation contribution of critical habitat to recovery of MSO (USDI FWS 2012). The 2012 BO concluded that continued implementation of the 1986 forest plan, as amended, would not likely jeopardize the continued existence of the MSO and is not likely to destroy or adversely modify designated critical habitat. Standards and guidelines for alternative 1 have not changed since the 2012 BO was finalized and can largely be found under management prescriptions applicable to all areas for Old Growth and Mexican Spotted Owl (1996 Amendment, pages 87-91).

The 1986 forest plan, as amended, does not define specific desired fire regimes, or contain objectives for frequency of fire to maintain or improve stand structure, maintain or decrease fuel loads, or to achieve other resource benefits. With the continued lack of fire disturbance, the risk of losing frequent fire forest vegetation systems to stand-replacing wildfire and the resulting uncharacteristic open state increases over time. The potential loss of ecological condition components due to large, high-severity wildfires could have particularly negative effects on Mexican spotted owl within these ERUs. However, the 2012 Planning Rule would require us to incorporate the desired conditions and other plan components to the current forest plan to be in compliance with the 2012 Rule. This would then address some of the issues discussed earlier in this paragraph and provide management guidance that would improve resiliency of forests to help minimize the potential of stand-replacing events resulting in uncharacteristic open states. Currently, while there may not have been plan components specifically addressing stand structure, fuel loads, etc., they were still addressed through implementation of BMPs, through following requirements listed in recovery plans, or through site-specific project design.

The ERUs that MSO use for nesting and roosting Ponderosa Pine Forest, Mixed Conifer-Frequent Fire, and Mixed Conifer with Aspen (PPF, MCD, and MCW) are moderately to highly departed, but slowly trending toward reference conditions, which should continue. Alternative 1 would continue to maintain current rates of planned and unplanned natural ignition and mechanical vegetation treatment which would continue to move those vegetation states toward desired conditions, but at a slower rate than any of the action alternatives for MSO. Ponderosa pine would remain highly departed (78 percent departure), relatively stable but a slight improvement from current conditions (79 percent departure). Mixed conifer frequent fire forest would remain moderately departed under this alternative's desired condition after 10-15 years and would remain relatively stable, but increasing to 56 percent up from 55 percent departure. Mixed Conifer with Aspen would improve to a low departure rating, changing from 40 percent to 30 percent departure. Under the current plan, habitat for MSO is moderately to highly departed but trending toward reference conditions. For MSO, based on vegetation modeling (see Upland Vegetation, Fire Ecology, and Fuels analysis methodology), it is estimated that the amount of Ponderosa Pine Forest Gambel Oak subtype available for nesting and roosting would decrease slightly over the next 10 to 15 years from 61 percent to 57 percent (382,202 acres to 358,313 acres). While this may seem negative, consider that in this ERU the desired amount of nest/roost habitat for MSO should be approximately 9 percent (56,725 acres). Mixed Conifer-Frequent Fire nest/roost habitat would also decrease slightly from 55 percent to 49 percent (217,102 acres to 191,852 acres), with the desired amount of nest/roost habitat should be 25 percent (98,893 acres). Mixed Conifer with Aspen nest/roost habitat also decreases from 72 percent to 67 percent (53,106 acres to 49,428 acres), with the desired amount of 93 percent (68,887 acres).

While some individual owls could be impacted by actions in the forest, this alternative's management activities would not adversely affect the viability of the species, which would be maintained.

Southwestern willow flycatcher, western yellow-billed cuckoo and New Mexico meadow jumping mouse

Key Ecological Conditions: For SWWF and WYBC, riparian and wetland thickets generally of willow, tamarisk, or both, sometimes boxelder or Russian olive. The NMMJM habitat requirements are characterized by tall (averaging at least 61 centimeters (24 inches)), dense riparian herbaceous vegetation (plants with no woody tissue) primarily composed of sedges (plants in the Cyperaceae Family that superficially resemble grasses but usually have triangular stems) and forbs (broad-leafed herbaceous plants) adjacent to seasonally available or perennial flowing water.

Key Threats: for SWWF and WYBC, loss of riparian habitat from floods, unauthorized use and recreation (no components developed for illegal activities), uncharacteristic fire, nest parasitism, agriculture (does not occur on NF lands), water diversions (none planned by the Gila NF), and non-native plant invasion, particularly tamarisk. NMMJM threats include water shortages, excessive grazing, or wildfire and post-fire flooding.

Southwestern willow flycatcher (SWWF) and its designated critical habitat was analyzed in the Continued Implementation of the Land and Resource Management Plans (LRMP) for the Eleven National Forests and National Grasslands of the Southwestern Region (USDA FS 2011) with USFWS providing a BO in 2012. They are protected by standards and guidelines (S&Gs) included in Amendment No. 10-Inventory and Management of Riparian Areas. Projects and program activities implemented under the 1986 forest plan, as amended, may occur near or within critical habitat. While the standards and guidelines provide protection for the SWWF and maintain their viability in the forest, activities may be permitted, authorized, or funded which may negatively affect individuals or affect designated critical habitat.

According to the 2012 BO, the overall assessment of the 1986 forest plan, as amended, the majority of the S&Gs were positive for SWWF. There were several addressing restoration activities in the uplands, as well as non-native plant removal, particularly tamarisk, within the riparian areas. There were some S&Gs that may have short-term adverse effects to SWWF as a result of their implementation (USDI FWS 2012), mainly within the Fire Management and Watershed Management program areas. However, it was determined that those S&Gs should result in long-term beneficial affects to the SWWF. The Gila NF has been proactive in efforts related to the recovery and conservation of the SWWF through implementing actions identified by the Recovery Team to be necessary to recover the species. The 2012 BO concluded that continued implementation of the 1986 forest plan, as amended, would not likely jeopardize the continued existence of SWWF and is not likely to destroy or adversely modify designated critical habitat. Standards and guidelines for alternative 1 have not changed since the 2012 BO was finalized where it was found that the majority of S&Gs would be beneficial to the species.

According to the 2012 BO, while implementation of conservation measures and S&Gs from Amendment No. 10-Inventory and Management of Riparian Areas should go a long ways toward improving riparian conditions for species that utilize riparian areas. Riparian and aquatic systems are in low to moderate departure. Alternative 1 would continue to maintain current rates of riparian habitat improvement, which would move those vegetation states toward desired conditions at a slower rate than any of the action alternatives.

While some individual SWWFs could be impacted by actions in the forest, the alternative management activities would not adversely affect the viability of the species, which would be maintained.

Western yellow-billed cuckoo (WYBC) and New Mexico meadow jumping mouse (NMMJM) were listed as threatened and endangered in 2014, respectively. Critical habitat was proposed for WYBC in the Gila NF, but no critical habitat was proposed or designated for NMMJM. NMMJM was only recently found in the Gila NF in late summer of 2018. Excessive grazing is listed as a threat to NMMJM, but there are several BMPs as well as S&Gs that provide utilization levels on managed livestock grazing. However, these utilization levels may not provide the specific habitat requirements needed for NMMJM of 24-inch tall dense riparian vegetation. Management recommendations would be provided for through project-level management decisions and following requirements established in the most recent recovery plan for the species. The area where the species was found did have suitable habitat under the current grazing management practices. WYBC was analyzed in a BA and sent to USFWS for Reinitiation of Consultation for the LRMP in 2015, but the NMMJM has not as of yet.

Both WYBC and NMMJM would be protected by S&Gs from Amendment No. 10-Inventory and Management of Riparian Areas. There were several addressing restoration activities in the uplands, as well as non-native plant removal, particularly tamarisk, within the riparian areas. While the standards and guidelines provide protection for these species and maintain their viability on the forest, activities may be permitted, authorized, or funded which may negatively affect individuals. Riparian and aquatic systems are in low to moderate departure. Alternative 1 would continue to maintain current rates for riparian habitat improvement, which would move those vegetation states toward desired conditions at a slower rate than any of the action alternatives.

While some individuals of these species could be impacted by actions in the forest, this alternative's management activities would not adversely affect the viability of these two species, which would be maintained.

Chihuahua chub, Gila chub, Gila trout, loachminnow, and spikedace

Key Ecological Conditions: Deeper waters, especially pools, or remaining near cover including terrestrial, overhanging vegetation, boulders, large woody debris, exposed root masses of trees at water's edge, fallen logs, undercut banks, streams having relatively natural flow regimes, and a predominance of native species.

Key Threats: Changes in flow regimes and stream characteristics from uncharacteristic fire in the uplands, unauthorized use (no components developed for illegal activities), agricultural (does not occur on national forest lands), water diversions (none planned by the Gila NF), and competition/predation/hybridization by non-native aquatic species.

These fish species and their designated critical habitat (Gila chub, loachminnow, spikedace) are protected by the standards and guidelines included in the 1996 plan amendment (1986 forest plan, as amended), including the S&Gs from Amendment No. 10-Inventory and Management of Riparian Areas. The majority of the S&Gs within the Gila NF forest plan maintain habitat and provide for recovery of these species. Additionally, there are several S&Gs that are beneficial in the long-term but have some short-term adverse effects. There are multiple S&Gs that maintain habitat or provide recovery to these species. Those applicable S&Gs either work toward maintaining current riparian conditions or toward improving riparian conditions to a satisfactory level. Several of these S&Gs also point toward improving and/or maintaining watershed condition. Those S&Gs that are directed at improving or maintaining habitat will circumvent further habitat loss and modification. There are plan components in the existing plan that discuss favoring native species, but nothing that directs us to remove any non-native aquatics. However, projects have been proposed and implemented to remove non-native aquatic species that could prey upon, compete against, or hybridize with these species. Projects and program activities implemented under the current forest plan may occur near or within occupied streams or within critical habitat. While the standards and guidelines provide protection for the fish and maintain their viability in the forest, activities may be permitted, authorized, or funded, which may negatively affect individuals or affect designated critical habitat.

According to the (2012) BO, the overall assessment of the 1986 forest plan, as amended, was that the plan has a considerable amount of positive guidance for listed species and will not appreciably impact any of these fish species or their critical habitat. Implementation of conservation measures and S&Gs from Amendment No. 10-Inventory and Management of Riparian Areas should go a long ways toward improving riparian conditions for species that utilize riparian and aquatic areas. Riparian and Aquatic systems are in low to moderate departure. The Gila NF is proactive in regards to implementing conservation actions for these species that serve to minimize impacts to the species, and while there may be short-term impacts, they will provide a long-term benefit to these species. These actions have contributed positively, particularly for the Gila trout, such that the trout was downlisted from endangered to threatened in 2005 (USDI FWS 2012). These conservation actions will continue into the future.

The 2012 BO concluded that for all species described here, the continued implementation of the 1986 forest plan, as amended, would not likely jeopardize the continued existence of these species and is not likely to destroy or adversely modify designated critical habitat. Standards and guidelines for alternative 1 have not changed since the 2012 BO was finalized. Alternative 1 would continue to maintain current rates of riparian habitat improvement, which would move those vegetation states toward desired conditions at a slower rate than any of the action alternatives.

While some individuals of these species could be impacted by actions in the forest, this alternative's management activities would not adversely affect the viability of these species, which would be maintained.

Mexican gray wolf

The reintroduced population of Mexican gray wolves in the Blue Range Wilderness Recovery Area has been designated as an experimental, nonessential population. By definition, a nonessential experimental population is not essential to the continued existence of the species. Therefore, no proposed action impacting the experimental, nonessential population so designated under the ESA §10(j) could lead to a jeopardy determination for the entire species. Additionally, the forest coordinates with the Wolf Recovery Team to ensure any activities occurring on NFS lands minimize any impacts to wolf breeding/denning activities. In 2011, the Forest Service submitted a biological assessment (BA) to the USFWS, which determined that the continued implementation of the Gila NF forest plan is not likely to jeopardize the continued existence of the Mexican gray wolf.

The 2012 BO concurred with the Forest Service determination that the continued implementation of the S&Gs within the Gila NF forest plan is not likely to jeopardize the continued existence of the §10(j) nonessential, experimental population for the following reasons:

1. Overall, the Gila NF forest plan is generally positive for the long-term conservation and recovery of the experimental population due to land acquisitions for threatened and endangered species; a focus on watershed restoration; management of threatened and endangered species habitat prioritized over other species; standards for reintroduction of threatened and endangered species; management directed at de-listing threatened and endangered species; planning emphasis on threatened and endangered species; management for indigenous species; and maintenance of threatened and endangered species habitats forest-wide in Management Areas 2A, 2B, 2C, 3D, 4A, 5B, and 5C.

2. The 1996 Regional LRMP is neutral toward the long-term conservation and recovery of the Mexican gray wolf.

3. By definition, a nonessential experimental population is not essential to the continued existence of the species; therefore, no proposed action impacting the experimental, nonessential population so designated under the ESA §10(j) could lead to a jeopardy determination for the entire species.

Environmental Consequences Common to Federally Listed Species for Alternatives 2 through 5

Because forest plans are permissive in nature unless they expressly prohibit activities, the more detailed plan components developed through the 2012 Planning Rule tend to give a narrower range of outcomes than the current plan. Therefore, action alternatives 2, 3, 4, and 5 are more strategic in nature and integrated than alternative 1. All action alternatives were developed using the coarse-filter/fine-filter approach to develop plan components to support at-risk species, which includes federally listed species, consistent with the 2012 planning rule. This approach is critical in enabling the adaptive management feedback loop between the plan and the plan monitoring program and would help ensure that the ecological conditions for federally listed species are maintained and would provide for their persistence. All action alternatives include plan direction designed to maintain the diversity of plant and animal communities and support persistence of native species within the plan area, subject to Forest Service authority and the inherent capability of the plan area.

The main differences between alternatives 2, 3, 4, and 5 that could impact federally listed species include the amount of acres recommended to Congress for wilderness designation, the amount and role of mechanical treatments and wildland fire as restoration tools, and the amount of riparian/aquatic systems restored. The action alternatives more proactively incorporate this thinking than alternative 1. The action alternatives also make better use of partnerships and collaboration to maintain ecosystem integrity and resilience.

Adaptive management will be essential to effectively manage for climate change and associated impacts from disturbance events and invasive species in changing and uncertain conditions. The action alternatives include a monitoring plan designed to better inform the effects and effectiveness of management and progress toward desired conditions. Alternatives 2, 3, 4, and 5 better recognize and address the negative effects non-native invasive species and disease can have on ecosystem integrity and biological diversity. Direction for invasive species was updated and expanded to recognize the threats to ecosystem resilience from all non-native invasive aquatic and terrestrial plants and animals likely to cause harm to ecosystems. Finally, climate change may push rare and endemic species to the limits of their range and evolutionary capacity. This is expected to be especially significant in the Southwest, an area already affected by long-term drought. The action alternatives recognize and include plan components to help address that threat and to reduce the risk of removing ecological conditions important for federally listed species.

Recommended wilderness is proposed under alternatives 2 through 5, and the amount of recommended wilderness varies by alternative as shown in table 24 below:

Table 24. Acres of recommended wilderness by alternative

Alternative	Acres of Recommended Wilderness
Alternative 2	110,402
Alternative 3	130,012
Alternative 4	72,901
Alternative 5	745,286

Recommended wilderness could potentially provide beneficial effects to federally listed species through its management for the protection or improvement of wilderness character, which minimizes disturbance to federally listed species and provides habitat connectivity. However, the Gila NF would also be more limited in its ability to treat these areas through mechanical cutting or prescribed fire and would rely on wildland fire as its main restoration tool. Limiting the ability to treat these areas may leave these areas vulnerable to large, contiguous extents of high-severity fire and cause these areas to become more departed in the future. More departed ecological conditions in the future may negatively affect federally listed species dependent on this habitat.

Plan components that support resilient and resistant ecosystems and watersheds, would protect species from the negative effects of climate change and would give wildlife species the best opportunity to adapt to changing conditions. This type of plan language, which is included in the four action alternatives, is not explicitly called out under alternative 1 and should have a more positive effect on all federally listed species. A comprehensive list of plan components that would benefit wildlife species has been put together in a crosswalk list (appendix D), and we direct the reader to this appendix to see specific examples, so they will not all be presented in this section.

All four action alternatives reference the most current recovery plans for listed species, which would allow them to adapt to changing ideas and thinking, as new science emerges and the recovery plans are updated over time. This is a key difference compared to alternative 1, which sometimes references outdated recovery plans and scientific information.

Chiricahua leopard frog, narrow-headed garter snake, and Northern Mexican garter snake

Key Ecological Conditions: Variety of structure and cover, emergent or submergent vegetation, abundant riparian vegetation, overhanging banks, rocky streams, permanent water

Key Threats: Disease, particularly Chytrid, reduced water sources, predation/competition by non-native aquatic species, altered hydrologic function from unauthorized use and recreation (no components developed for illegal activities), water diversions (none planned by the Gila NF), decline of native fish

Southwestern willow flycatcher, western yellow-billed cuckoo, and New Mexico meadow jumping mouse

Key Ecological Conditions: For SWWF and WYBC, riparian and wetland thickets generally of willow, tamarisk, or both, sometimes boxelder or Russian olive. The NMMJM habitat requirements are characterized by tall (averaging at least 61 centimeters (24 inches)), dense riparian herbaceous vegetation (plants with no woody tissue) primarily composed of sedges (plants in the Cyperaceae Family that superficially resemble grasses but usually have triangular stems) and forbs (broad-leafed herbaceous plants) adjacent to seasonally available or perennial flowing water.

Key Threats: For SWWF and WYBC, loss of riparian habitat from floods, unauthorized use and recreation (no components developed for illegal activities), uncharacteristic fire, nest parasitism, agriculture (not on NFS lands), water diversions (none planned by the Gila NF), and non-native plant invasion, particularly tamarisk. NMMJM threats include water shortages, excessive grazing, or wildfire and post-fire flooding.

Riparian habitat includes wetlands and forested riparian (i.e., willow, cottonwood, and sycamore) areas surrounding seeps/springs, perennial streams, lakes, and other water features. According to the Gila NF Final Assessment (2017), riparian habitat occupies a very small portion of the forest and riparian conditions range from low to moderate departure, so maintaining the low departure riparian systems while improving the moderately departed riparian systems would likely improve ecological conditions for these species. These species would benefit from plan components that maintain or improve riparian and aquatic conditions toward reference conditions. All action alternatives will maintain riparian management zones in, or trending toward proper functioning condition (or equivalent condition class). No new construction or realignment of roads and motorized routes, recreation sites or other infrastructure should be located within the 100-year floodplain, or within 300 feet of a riparian management zone for alternatives 2, 3, and 4, and 500 feet of a riparian management zone containing perennial streams or native trout populations in alternative 5. Also, improving conditions in the upland systems would further improve ecological conditions across the landscape, and minimize impacts to riparian systems from disturbances in the uplands.

Plan components that would benefit the species that depend on these vegetation communities can be found under the Watershed, Water Quality, Riparian and Aquatic Ecosystems, All Upland ERUs, Non-native Invasive Species, and Wildlife, Fish, and Plants plan sections of the action alternatives. Additional plan components, which balance multiple use with wildlife needs, can be found under the Wildland Fire and Fuels Management, Water Uses, Livestock Grazing, Timber, Forest, and Botanical Products, Roads, Minerals, and Dispersed Recreation sections.

Coarse filter
Plan components within all of the above-mentioned resource sections would help to move these systems toward proper functioning condition (e.g., Riparian and Aquatic Ecosystems Watershed Scale DC3, Fine Scale DC1)[x], while balancing multiple uses with ecological integrity (Livestock Grazing GL1) to avoid excessive grazing impacts. This would provide the key ecological conditions needed for the species life functions. These components would help to minimize water diversions and improve hydrologic function, while maintaining systems that are resilient to climate change and associated disturbances, such as fire (Livestock Grazing GL4). There are also standards and guidelines within several sections (e.g., Watershed STD1, Livestock Grazing STD1) that would ensure that BMPs are applied to every site-specific project that has the potential to affect watershed conditions such as erosion and flooding effects due to wildfires. Several standards and guidelines would mitigate adverse effects from road construction or reconstruction (Roads DC4, GL1-4), which can cause sedimentation, and would rehabilitate in-stream structures (Wildlife, Fish, and Plants DC9), which could improve hydrologic function.

Desired conditions and standards within the Timber, Forest, and Botanical Products (DC1, STDs 1, 3, 5) would protect the ecological integrity of watershed conditions by minimizing potentially adverse effects that could cause soil erosion and sedimentation during timber harvest operations. Plan components for Livestock Grazing (DC 3 and 4, STDs 1 and 3, GL 1, 2, 4, and 5), Riparian and Aquatic Ecosystems (Watershed Scale DC1 and 3, Fine Scale DC1 and 2, STDs 1 and 2), Water Uses (DC1), and Roads (DC 4 and 5, GL 1, 3, and 4) would ensure associated management activities are compatible with ecological function and supportive of diverse native plant communities, including in wetland and riparian management zones. Many of these same plan components also would protect riparian areas from streambed and flood plain alteration, and would minimize disturbance (e.g., water flow, sedimentation) from the construction of roads and energy corridors by including mitigations to limit disturbance during project-level design.

Livestock grazing guidelines 1 and 3 prevent the construction of new structures in riparian management zones and minimize potentially adverse effects that the construction of such structures may have on soils and hydrologic function of streams.

[x] DC=Desired Condition; OB=Objective; STD=Standard; GL=Guideline

Non-native plant species (e.g., tamarisk) can out compete native species, causing a reduction in suitable habitat for these species and alterations in riparian function, while non-native invasive animals and disease pathogens (e.g., Chytrid) can cause direct mortality and predation. These threats are reduced through plan components in the Non-native Invasive Species (DC1 and 2, STDs 1-3, 7, and 9, GL 1, 4-7) and Wildland Fire Management (DC 6, STDs 4-6, GL 2) that minimize impacts to wildlife in riparian areas, and would also prevent pathogen transmission.

<u>Fine Filter</u>
For these species, the coarse filter plan components described above should address the key ecological conditions and threats for all of them. There is, however, a fine filter plan component in the Non-native Invasive Species (GL7) resource section that specifically addresses the amphibian and reptile species. This guideline specifically states that any habitat or aquatic improvement and restoration projects within areas occupied by these species, as well as native fish species, there should be provisions to remove any non-native invasive animals.

Management approaches have been identified in several resource area sections that would support the management these species. The following is an example of one:

Coordinate with the NMDGF and USFWS regarding listed and native species, reintroductions, introductions, or transplants of listed or native species, control or eradication of non-native species, and the management of sport and native fishes, including the identification of refugia for native fish (that is, native only stream reaches). Work with the USFWS, NMDGF, and other partners to develop conservation measures (for example, public education to reduce human impacts) to prevent listing and to aid to in the recovery and delisting of federally listed species.

Mexican spotted owl

<u>Key Ecological Conditions:</u> Mixed coniferous and pine/oak forests, canyons, desert caves, cliff faces, and riparian areas. Forested habitat is typically uneven-aged, multi-storied, and has high canopy closure.

<u>Key Threats:</u> Habitat loss due to historical even-aged silvicultural treatments, uncharacteristic wildfire, and increased human activities in proximity to nest/roost territories (PACs).

Mexican spotted owl would benefit primarily from plan components that move moderately to highly departed ERUs required for nesting/roosting (PPF, MCD, and MCW) toward desired conditions. The objectives and effects differ across the action alternatives and the total amount of ecological condition moved toward desired conditions over the 15-year life of the plan varies across alternatives. The differing amounts of ecological condition improved are highlighted in the individual sections for each alternative in their respective vegetation sections. Mexican spotted owls need diverse forest structure, old growth components, and are dependent on large trees, coarse woody debris, snags, and tree-related components for roosting, foraging, and nesting. Downed, woody material and logs provide important ecological condition for small mammalian prey species. In addition to the components described above, Mexican spotted owls would also benefit from a number of ecosystem-level plan components, which would protect these key ecological conditions.

<u>Coarse filter</u>
Coarse-filter plan components that would benefit Mexican spotted owls that depend on Forested Ecosystems include desired conditions for PPF, MCD, and MCW ERUs to maintain appropriate structure, composition, and function at the landscape-, mid-, and fine-scales while reducing fire risk

through vegetation management and fuels reduction projects. Desired conditions that incorporate varying structural stages, including uneven-aged forest with openings and occasional even-aged structure with large snags and abundant understory (e.g., coarse woody debris, logs), and old growth components would guide the implementation of forest management activities that would move these ERUs toward a more favorable departure and trend from that which currently exists. Structural departure from desired conditions tend to equate to departure of the fire regime for these vegetative ERUs. Restoring structure of these ERUs would also contribute to restoring natural fire regimes and reduce the risk of large extents of high severity fire and associated effects. The full range of life stage needs for Mexican spotted owls (e.g., fledgling, nesting, dispersal, roosting), as well as conditions that would support an adequate prey base for foraging are provided for in the Desired Conditions at all scales. There are also Coarse-filter plan components to maintain appropriate levels of old trees, snags, nesting structures (e.g., witches brooms), and downed wood at multiple spatial scales for Mexican spotted owls. (See all Desired Conditions for all scales for PPF, MCD, and MCW ERUs.)

Where Gambel oak and other hardwoods occur as a component in conifer forest, desired conditions (All Upland ERUs – DC 1, 2, 6, and 8, GL 1 and 2, MCW, MCD, and PPF – DC 1, and PPF DC 3) would promote their retention during project design to promote canopy cover and moister site conditions for small mammals, plants and insects.

Desired conditions mentioned above, plus additional coarse-filter plan components under the Wildland Fire and Fuels Management resource area promote endemic levels of disturbance, natural fire regimes, and restoration activities that would allow all forested ERUs to be resilient in the face of climate change, drought, and other disturbance. These include (DC 2 and 5, and GL 1). These DCs and guidelines would also protect or enhance Mexican spotted owl habitat, including critical habitat from wildland fire and fuels management activities.

Current silvicultural treatments are no longer considered threats to Mexican spotted owl as they are planned and implemented to modify forest structure to promote MSO habitat. There may be short-term impacts due to disturbance, but does not contribute to habitat loss. The Timber, Forest, and Botanical Products resource area would ensure that silvicultural treatments are used as a restoration tool and desired conditions for this resource (DC 1a-c) would ensure these types of activities are done in a way that enhances MSO ecological condition requirements. Desired conditions mentioned previously for vegetation ERUs would also contribute toward improving MSO habitat, particularly with regard to snags and dying trees (MCW Landscape DC 3 and 4, Mid-scale DC 3 and 4, MCD Landscape DC 3 and 4, Mid-scale DC 4 and 5, and PPF Landscape DC 4 and 5, and Mid-scale DC 4 and 5).

Fine Filter

Total visitation to the Gila NF increased by 69 percent (from 305,000 to 514,000 visitors) between 2006 and 2011, and then declined 25 percent from 2011 to 2016 (from 514,000 to 390,000 visitors) based on the NVUM data collected in the Gila NF. Overall, there was an increase of 28 percent in visitation from 2006 to 2016. The greatest increase in visitation came in the General Forest Area visitation category, which is considered within undeveloped areas of the forest with the exception of roads and trails. General uses are for dispersed recreation that includes dispersed camping, off-highway vehicle riding, hunting, backpacking, and horseback riding (see Recreation section). While visitation has increased in the Gila NF, it is difficult to know if public visitation in this category for their general uses through Mexican spotted owl PACs has increased. Other recreation types like developed campgrounds or other sites is well managed and Mexican spotted owls tend to use areas that are away from these concentrated human activities. Further, the most recent MSO Recovery Plan addresses any increase in human disturbances within or near MSO PACs for any Federal activities by implementing breeding season restrictions for any activities within PACs. This will continue to be implemented throughout the life of the plan.

Chihuahua chub, Gila chub, Gila trout, loachminnow, and spikedace

Key Ecological Conditions: Deeper waters, especially pools, or remaining near cover including terrestrial, overhanging vegetation, boulders, large woody debris, exposed root masses of trees at water's edge, fallen logs, undercut banks, streams having relatively natural flow regimes, and a predominance of native species.

Key Threats: Changes in flow regimes and stream characteristics from uncharacteristic fire in the uplands, unauthorized use (no components developed for illegal activities), agricultural (not on NF lands), water diversions (none planned by the Gila NF), and competition/predation/hybridization by non-native aquatic species.

Aquatic habitats these species use would benefit primarily from some of the same plan components that go toward improving riparian habitat. Additionally, plan components that improve upland conditions would benefit aquatic habitats by reducing the amount of sedimentation after disturbances and maintaining or improving hydrologic flows.

Riparian habitat includes wetlands and forested riparian (i.e., willow, cottonwood, and sycamore) areas surrounding seeps/springs, perennial streams, lakes, and other water features. According to the Gila NF Final Assessment (USDA FS Gila NF 2017), riparian habitat occupies a very small portion of the forest and riparian conditions range from low to moderate departure, so maintaining the low departure riparian systems while improving the moderately departed riparian systems would likely improve ecological conditions for these species. These species would benefit from plan components that maintain or improve riparian and aquatic conditions toward reference conditions. All action alternatives will maintain Riparian Management Zones in, or trending toward proper functioning condition (or equivalent condition class). No new construction or realignment of roads and motorized routes, recreation sites or other infrastructure should be located within the 100-year floodplain, or within 300 feet of a Riparian Management Zone for alternatives 2, 3, and 4, and 500 feet of a riparian management zone containing perennial streams or native trout populations in alternative 5. Also, improving conditions in the upland systems would further improve ecological conditions across the landscape, and minimize impacts to aquatic systems from disturbances in the uplands.

Plan components that would benefit the species that depend on aquatic systems that are surrounded by these vegetation communities can be found under the Watershed, Water Quality, Riparian and Aquatic Ecosystems, All Upland ERUs, Non-native Invasive Species, and Wildlife, Fish, and Plants plan sections of the action alternatives. Additional plan components, which balance multiple use with wildlife needs, can be found under the Wildland Fire and Fuels Management, Water Uses, Livestock Grazing, Timber, Forest, and Botanical Products, Roads, Minerals, and Dispersed Recreation sections.

Coarse filter

Plan components within all of the above-mentioned resource sections would help to move these systems toward proper functioning condition (e.g., Riparian and Aquatic Ecosystems Watershed Scale DC3, Fine Scale DC1), while balancing multiple uses with ecological integrity (Livestock Grazing GL1) to avoid excessive grazing impacts. This would provide the key ecological conditions needed for the species life functions. These components would help to minimize water diversions and improve hydrologic function, while maintaining systems that are resilient to climate change and associated disturbances, such as fire (Livestock Grazing GL4). There are also standards and guidelines within several sections (e.g., Watershed STD1, Livestock Grazing STD1) that would ensure that BMPs are applied to every site-specific project that has the potential to affect watershed conditions such as erosion and flooding effects due to wildfires. Several standards and guidelines would mitigate adverse effects from road construction or reconstruction (Roads DC4, GL1-4), which can cause sedimentation, and would also rehabilitate in-stream structures (Wildlife, Fish, and Plants DC9), which could improve hydrologic function.

Desired conditions and standards within the Timber, Forest, and Botanical Products (DC1, STDs 1, 3, 5) would protect the ecological integrity of watershed conditions by minimizing potentially adverse effects that could cause soil erosion and sedimentation during timber harvest operations. Plan components for Livestock Grazing (DC 3 and 4, STDs 1 and 3, GL 1, 2, 4, and 5), Riparian and Aquatic Ecosystems (Watershed Scale DC1 and 3, Fine Scale DC1 and 2, STDs 1 and 2), Water Uses (DC1), and Roads (DC 4 and 5, GL 1, 3, and 4) would ensure associated management activities are compatible with ecological function and supportive of diverse native plant communities, including in wetland and riparian management zones. Many of these same plan components also would protect riparian areas from streambed and flood plain alteration, and would minimize disturbance (e.g., water flow, sedimentation) from the construction of roads and energy corridors by including mitigations to limit disturbance during project-level design.

Livestock Grazing guidelines 1 and 3 prevent the construction of new structures in riparian management zones and minimize potentially adverse effects that the construction of such structures may have on soils and hydrologic function of streams.

Non-native plant species (e.g., tamarisk) can out compete native species, causing a reduction in suitable habitat for these species and alterations in riparian function, while non-native invasive animals and disease pathogens (e.g., Chytrid) can cause direct mortality and predation. These threats are reduced through plan components in the Non-native Invasive Species (DC1 and 2, STDs 1-3, 7, and 9, GL 1, 4-7) and Wildland Fire Management (DC 6, STDs 4-6, GL 2) that minimize impacts to wildlife in riparian areas, and would also prevent pathogen transmission.

Plan components have been developed to implement 20 activities and projects that contribute to the recovery of federally listed species and maintain or enhance upland habitat connectivity over each 10-year period (Wildlife, Fish, and Plants OB-3 and 5), and objectives to restore, enhance, or maintain 100 stream miles (Wildlife, Fish, and Plants OB-4).

Fine Filter

Plan components designed to reduce non-native fish and other aquatic species within native aquatic populations 4-6 stream reaches, and eradicate non-native fish populations to reduce impacts from predation/competition/hybridization from at least one stream reach containing a natural or constructed barrier in compliance with recovery plans during each 10-year period (Non-native Invasive Species OB-4 and 5, respectively) would further address threats to these species.

Environmental Consequences for Federally Listed Species - Alternatives 2 and 5

Alternatives 2 and 5 retain relevant plan direction from alternative 1 but are more responsive to current science and thinking while addressing the core themes and significant issues explored during the plan revision process. The differences between alternatives 2 and 5 is the amount of recommended wilderness, which was discussed in the effects common to all action alternatives, the addition of three botanical areas and their acreage amounts, and differences in acreage amounts treated through mechanical cutting and wildland fire. The primary differences between alternatives 2 and 5 and the other alternatives is the addition of the three recommended botanical areas with their own plan components and different acreage amounts of the areas between the two alternatives.

Botanical areas are proposed under alternatives 2 and 5, and the acreage amount of proposed botanical areas vary by alternative as shown in the table 25.

Table 25. Acres within proposed botanical areas, by alternative

Alternative	Mogollon Mountains	Pinos Altos Range	Emory Pass
2	45,029	6,198	16,944
5	98,510	20,930	31,150

Plan components for the proposed botanical areas focus on promoting values of rare and endemic plant populations while providing opportunities for stakeholder engagement and education. No new motorized routes will be constructed within the proposed botanical areas and maintenance on existing routes will minimize ground disturbance outside existing road prism and associated drainage features. Designated camping areas will be delineated in the botanical areas that are located outside of designated wilderness and should include educational, interpretive signage. Additionally, the use of non-selective herbicides or herbicides that may have activity on rare and endemic plant species will not occur in special botanical areas unless it is to control or eradicate noxious weed species, and other integrated pest management efforts have failed or are not likely to be successful. If such herbicide use is necessary, mitigation plans to minimize impacts to rare and endemic species populations will be developed and implemented. The plan components provided for the proposed botanical areas would benefit rare and endemic plants by bringing an awareness to their value, but also to other species that occur within them that could potentially be impacted by human disturbance through roads or dispersed camping, as well as any impacts from herbicide use. All other plan components would remain the same as those listed under All Action Alternatives. In addition to the environmental consequences for all alternatives above, alternatives 2 and 5 would primarily differ from alternative 1 in the rate and magnitude of ecological condition restored overall.

Chiricahua leopard frog, narrow-headed garter snake, Northern Mexican garter snake, southwestern willow flycatcher, western yellow-billed cuckoo, New Mexico meadow jumping mouse, Chihuahua chub, Gila chub, Gila trout, loachminnow, and spikedace

Riparian habitat occupies a very small portion of the forest and riparian conditions range from low to moderate departure. Treatments on the landscape in the uplands have the potential to increase sedimentation into riparian and aquatic areas. There is more acreage of treatment in alternatives 2 and 5 than alternative 1, but there are desired conditions, standards, and guidelines (e.g., Timber, Forest, and Botanical Products DC 1, STD 1 and 5, GL 3, 6, and 7) that would minimize these impacts, as well as reduce the potential for undesirable effects from uncharacteristic fire, drought, wind, insect infestations, and disease epidemics.

No new construction or realignment of roads and motorized routes, recreation sites or other infrastructure should be located within the 100-year floodplain, or within 300 feet of a riparian management zone for alternative 2, and 500 feet of a riparian management zone containing perennial streams or native trout populations in alternative 5. Preferential treatment will be given to riparian and aquatic resources (Riparian and Aquatic Ecosystems GL 6) in the forest for alternatives 2 and 5.

Set objectives to restore structure and function of at least one riparian project annually, above and beyond any noxious or invasive weed treatments (Riparian and Aquatic Ecosystems OB-1), 20 activities and projects that contribute to the recovery of federally listed species and maintain or enhance upland habitat connectivity over each 10-year period (Wildlife, Fish, and Plants OB-3 and 5), and objectives to restore, enhance, or maintain 100 stream miles (Wildlife, Fish, and Plants OB-4), and reduce non-native fish and other aquatic species within native aquatic populations 4-6 stream reaches, and eradicate non-native fish populations from at least one stream reach containing a natural or constructed barrier in compliance with recovery plans during each 10-year period (Non-native Invasive Species OB-4 and 5, respectively). This also includes Desired Conditions in the Roads resource area (DC5) and guidelines (G 1, 2, and 4) to close or naturalize roads to reduce impacts to ecological resources (that is, watersheds, wildlife and fish habitat, and soil erosion). These plan components would move riparian ecological condition across the forest closer to a desired state.

Moving toward desired conditions would improve ecological conditions necessary to maintain viability for these species by decreasing sedimentation and improving seral state distribution, surface flow timing and duration, and repairing disconnected floodplains. Plan components discussed under All Action Alternatives would help to offset any potentially adverse effects from these actions. Desired conditions would be achieved at a faster rate than alternative 1, and alternatives 2 and 5 would increase outcomes in terms of improving stream health, riparian habitat, and wetland integrity compared to alternative 1.

Determination: While some individuals could be impacted by actions in the forest, the alternative management activities would not adversely affect the viability of the species. Overall species viability would be maintained for all these species. Beneficial impacts include an improvement in watershed and riparian conditions.

Mexican spotted owl

Vegetation ERUs Ponderosa Pine Forest, Mixed Conifer-Frequent Fire, and Mixed Conifer with Aspen (PPF, MCD, MCW) used by Mexican spotted owls are moderately to highly departed but trending toward reference conditions. Alternatives 2 and 5 would increase the current rate of treatment through a combination of mechanical and wildland fire during each 10-year period. In MCW, the forest would treat between 300 and 73,934 acres per 10-year period using a combination of naturally ignited wildfire, prescribed fire, and mechanical methods (alternative 2) with no objective in this ERU for alternative 5, in MCD the forest would treat between 6,875 and 282,400 acres per 10-year period using a combination of naturally ignited wildfire, prescribed fire, and mechanical methods (alternative 2) and between 5,500 and 282,400 acres per 10-year period using a combination of naturally ignited wildfire and prescribed fire (alternative 5), and in PPF the forest would treat between 6,320 and 600,300 acres per 10-year period using a combination of naturally ignited wildfire, prescribed fire, and mechanical methods (alternative 2), and between 55,000 and 600,300 acres per 10-year period using a combination of naturally ignited wildfire and prescribed fire (alternative 5).

After 10 years, desired conditions for MCW and MCD would remain moderately departed but would move closer to the desired conditions, changing from departure of 40 percent to 35 percent (MCW alternatives 2 and 5), and 55 percent to 52 percent (MCD alternatives 2 and 5). PPF would remain highly departed but still moving closer to desired conditions, changing from 79 percent to 75 percent in alternative 2 and 74 percent in alternative 5. This would be an improvement over alternative 1 for all ERUs that MSO depend on except for MCW where alternative 1 would change from a moderate departure rating of 40 percent to low departure rating of 30 percent.

Vegetation modeling (see Upland Vegetation, Fire Ecology, and Fuels analysis methodology) for alternative 2 estimates that the amount of Ponderosa Pine Forest Gambel Oak subtype available for nesting and roosting would decrease over the next 10 to 15 years from 61 percent to 39 percent (382,202 acres to 243,287 acres). While this may seem negative, consider that in this ERU the desired amount of nest/roost habitat for MSO should be approximately 9 percent (56,725 acres). Mixed Conifer-Frequent Fire nest/roost habitat would also decrease slightly from 55 percent to 25 percent (217,102 acres to 97,192 acres), with the desired amount of nest/roost habitat should be 25 percent (98,893 acres). This would put this ERU right in line with the Desired Conditions. Mixed Conifer with Aspen nest/roost habitat also decreases from 72 percent to 52 percent (53,106 acres to 38,784 acres), with the desired amount of 93 percent (68,887 acres).

Vegetation modeling (see Upland Vegetation, Fire Ecology, and Fuels analysis methodology) for alternative 5 estimates that the amount of Ponderosa Pine Forest Gambel oak subtype available for nesting and roosting would decrease over the next 10-15 years from 61 percent to 27 percent (382,202 acres to 171,057 acres). While this may seem negative, consider that in this ERU the desired amount of nest/roost habitat for Mexican spotted owls should be approximately 9 percent (56,725 acres). Mixed Conifer-Frequent Fire nest/roost habitat would also decrease from 55 percent to 26 percent (217,102 acres to 102,334 acres), with the desired amount of nest/roost habitat should be 25 percent (98,893 acres). This would put this ERU right in line with the Desired Conditions. Mixed Conifer with Aspen nest/roost habitat also decreases from 72 percent to 52 percent (53,106 acres to 38,636 acres), with the desired amount of 93 percent (68,887 acres). For both alternatives 2 and 5, this would be below Desired Conditions for MCW; however, overall there would be an abundance of nest/roost habitat across the forest between all ERUs used for nesting/roosting. Additionally, since the model is not spatial in nature, it will not account for any refugial areas that may not readily burn or may be surrounded by areas treated and fire is not likely, or on steep slopes that may not be treated to conditions that would preclude nesting/roosting. Mechanical treatments in these areas would also be implemented in a way to ensure that they would maintain characteristics required for nesting/roosting and those characteristics would not be lost, as is outlined in the most recent recovery plan.

<u>Determination:</u> There could be some localized adverse impacts to Mexican spotted owl and its critical habitat by actions on the forest, but overall, Mexican spotted owl species viability would be maintained through these alternative's management activities, as there would continue to be more available nest/roost habitat that reference conditions indicate. Beneficial impacts include improved resiliency of the suitable or potentially suitable nest/roost habitat in the ERUs used by Mexican spotted owl for these activities by reducing fuel loads and returning disturbance regimes toward reference conditions.

Environmental Consequences for Federally Listed Species – Alternative 3

Alternative 3 was developed to respond to issues by placing more emphasis on mechanically treating grassland and open woodland vegetation to maintain or move toward desired conditions for those vegetation types. These efforts would prioritize restoring understory vegetation that could be used as forage for livestock grazing, which contributes to local and regional economic sustainability. The differences between this alternative is the amount of recommended wilderness, which was discussed in the effects common to all action alternatives, and differences in acreage amounts and ERUs emphasized to be treated through mechanical cutting and wildland fire which would be limited in its use. Management activities and permitted uses would maintain riparian management zones in, or trending toward proper functioning condition. There would be an emphasis in utilizing guidelines rather than standards for livestock grazing plan direction, and vacant allotments would be stocked to the maximum extent possible. Land adjustments would be balanced so that no-net loss of private property in a county occurred. Wilderness recommendations would be avoided in areas identified as needing restoration in grassland and open woodland vegetation, and areas providing access to traditional recreational, cultural, and historical uses of the forest. All other plan components would remain the same as those listed under All Action Alternatives. In addition to the environmental consequences for all alternatives above, alternative 3 would primarily differ from alternative 1 in the rate, magnitude, and ERU types of ecological condition restored overall.

Chiricahua leopard frog, narrow-headed garter snake, Northern Mexican garter snake, southwestern willow flycatcher, western yellow-billed cuckoo, New Mexico meadow jumping mouse, Chihuahua chub, Gila chub, Gila trout, loachminnow, and spikedace

Riparian habitat occupies a very small portion of the forest and riparian conditions range from low to moderate departure. Treatments on the landscape in the uplands, as well as fully stocking any vacant allotments, have the potential to increase sedimentation into riparian and aquatic areas. There is more acreage of treatment in alternative 3 that is focused within the grassland and open woodland ERUs than any other alternatives, and there are desired conditions, standards, and guidelines (e.g., Timber, Forest, and Botanical Products DC 1, STD 1 and 5, GL 3, 6, and 7) that would minimize these impacts, as well as reduce the potential for undesirable effects from uncharacteristic fire, drought, wind, insect infestations, and disease epidemics. While emphasizing treatment within these ERUs in an effort to provide for improved conditions or increased forage for livestock grazing, there are still plan components designed (Livestock Grazing DC 3 and 4, STDs 1 and 3, GL 1, 2, 4, and 5), to ensure grazing management activities are compatible with ecological function and supportive of diverse native plant communities, including in wetland and riparian management zones.

All other plan components are similar to the other action alternatives and would continue moving systems these species utilize toward desired conditions. This would continue to improve ecological conditions necessary to maintain viability for these species by decreasing sedimentation and improving seral state distribution, surface flow timing and duration, and repairing disconnected floodplains. Plan components discussed under All Action Alternatives would help to offset any potentially adverse effects from these actions. Desired conditions would be achieved at a faster rate than alternative 1, and this alternative would increase outcomes in terms of improving stream health, riparian habitat, and wetland integrity compared to alternative 1.

Determination: While some individuals could be impacted by actions in the forest, the alternative management activities would not adversely affect the viability of the species. Overall species viability would be maintained for all these species. Beneficial impacts include an improvement in watershed and riparian conditions.

Mexican spotted owl

Vegetation ERUs Ponderosa Pine Forest, Mixed Conifer-Frequent Fire, and Mixed Conifer with Aspen (PPF, MCD, MCW) used by Mexican spotted owls are moderately to highly departed but trending toward reference conditions. Alternative 3 would only have an objective for treatment activities in these ERUs where they occur within the WUI during each 10-year period. Within these vegetation types, the forest would treat at least 4,500 acres per decade using mechanical methods and no more than 725 acres per decade using prescribed fire. As most vegetative treatments and livestock grazing activities would be focused within the grassland and open woodland ERUs, this would not impact any nest/roost habitat for Mexican spotted owl. Riparian management would still be prioritized and conditions would continue to improve for those areas.

Since there will be very little focused treatment within these ERUs, after 10 years, desired conditions for MCW would move closer to the desired conditions and improving from moderately departed to low departure, changing from departure of 40 percent to 30 percent, while MCD would move away from desired conditions with departure rating going from 55 percent to 56 percent. PPF would remain highly departed, but still move slightly closer to desired conditions, changing from 79 percent to 78 percent. This would be similar to what would be expected under alternative 1 for all ERUs that Mexican spotted owls depend on.

Vegetation modeling (see Upland Vegetation, Fire Ecology, and Fuels analysis methodology) for alternative 3 estimates that the amount of Ponderosa Pine Forest Gambel Oak subtype available for nesting and roosting would slightly decrease over the next 10 to 15 years from 61 percent to 59 percent (382,202 acres to 372,494 acres). While this may seem negative, consider that in this ERU the desired amount of nest/roost habitat for MSO should be approximately 9 percent (56,725 acres). Mixed Conifer-Frequent Fire nest/roost habitat would also decrease slightly from 55 percent to 49 percent (217,102 acres to 192,880 acres), with the desired amount of nest/roost habitat should be 25 percent (98,893 acres). Mixed Conifer with Aspen nest/roost habitat also slightly decreases from 72 percent to 67 percent (53,106 acres to 49,621 acres), with the desired amount of 93 percent (68,887 acres).

<u>Determination:</u> There could be some localized adverse impacts to Mexican spotted owl and its critical habitat by actions on the forest, but overall, Mexican spotted owl species viability would be maintained through this alternative's management activities as there would continue to be more available nest/roost habitat that reference conditions indicate. Beneficial impacts include an improvement in watershed conditions, although not within nest/roost habitat but potentially foraging habitat, and riparian conditions.

Environmental Consequences for Federally Listed Species – Alternative 4

Alternative 4 was developed to respond to issues by placing more emphasis on mechanically treating forested/timberland vegetation to maintain or move toward desired conditions. These efforts would prioritize restoring forested vegetation that could also produce forest products, which contributes to local and regional economic sustainability. This alternative identifies more land suitable for timber production and would offer more wood products. The differences between this alternative is the amount of recommended wilderness, which was discussed in the effects common to all action alternatives, and differences in acreage amounts and ERUs emphasized to be treated through mechanical cutting and prescribed fire which would be limited in its use. Management activities and permitted uses would maintain riparian management zones in, or trending toward proper functioning condition. There would be an emphasis in utilizing guidelines rather than standards for livestock grazing plan direction, and vacant allotments would be stocked to the maximum extent possible. Land adjustments would be balanced so that no-net loss of private property in a county occurred. Wilderness recommendations would be avoided in areas identified as needing restoration in forested vegetation or being suitable for timber production, and areas providing access to traditional recreational, cultural, and historical uses of the forest. All other plan components would remain the same as those listed under All Action Alternatives. In addition to the environmental consequences for all alternatives above, alternative 4 would primarily differ from alternative 1 in the rate, magnitude, and ERU types of ecological condition restored overall.

Chiricahua leopard frog, narrow-headed garter snake, northern Mexican garter snake, wouthwestern willow flycatcher, western yellow-billed cuckoo, New Mexico meadow jumping mouse, Chihuahua chub, Gila chub, Gila trout, loachminnow, and spikedace

Riparian habitat occupies a very small portion of the forest and riparian conditions range from low to moderate departure. Treatments on the landscape in the uplands, as well as fully stocking any vacant allotments, have the potential to increase sedimentation into riparian and aquatic areas. There is more acreage of treatment in alternative 4 that is focused within the forested/timberland ERUs than any other alternatives, and there are desired conditions, standards, and guidelines (e.g., Timber, Forest, and Botanical Products DC 1, STD 1 and 5, GL 3, 6, and 7) that would minimize these impacts, as well as reduce the potential for undesirable effects from uncharacteristic fire, drought, wind, insect infestations, and disease epidemics. While emphasizing treatment within these ERUs in an effort to provide for more timber production and wood products, there are still plan components designed (Livestock Grazing DC 3 and 4, STDs 1 and 3, GL 1, 2, 4, and 5), to ensure grazing management activities and timber harvest activities (Timber, Forest, and Botanical Products DC1, STDs 1, 3, 5) are compatible with ecological function and supportive of diverse native plant communities, including in wetland and riparian management zones, and would protect the ecological integrity of watershed conditions by minimizing potentially adverse effects that could cause soil erosion and sedimentation during timber harvest operations. Additionally, plan components for Riparian and Aquatic Ecosystems (Watershed Scale DC1 and 3, Fine Scale DC1 and 2, STDs 1 and 2), Water Uses (DC1), and Roads (DC 4 and 5, GL 1, 3, and 4) would ensure associated management activities are compatible with ecological function and supportive of diverse native plant communities, including in wetland and riparian management zones. Many of these same plan components also would protect riparian areas from streambed and flood plain alteration, and would minimize disturbance (e.g., water flow, sedimentation) from the construction of roads by including mitigations to limit disturbance during project-level design.

All other plan components are similar to the other action alternatives and would continue moving systems these species utilize toward desired conditions. This would continue to improve ecological conditions necessary to maintain viability for these species by decreasing sedimentation and improving seral state distribution, surface flow timing and duration, and repairing disconnected floodplains. Plan components discussed under All Action Alternatives would help to offset any potentially adverse effects from these actions. Desired conditions would be achieved at a faster rate than alternative 1, and this alternative would increase outcomes in terms of improving stream health, riparian habitat, and wetland integrity compared to alternative 1.

Determination: While some individuals could be impacted by actions on the forest, the alternative management activities would not adversely affect the viability of the species. Overall species viability would be maintained for all these species. Beneficial impacts include an improvement in watershed and riparian conditions.

Mexican spotted owl

Vegetation ERUs Ponderosa Pine Forest, Mixed Conifer-Frequent Fire, and Mixed Conifer with Aspen (PPF, MCD, MCW) used by Mexican spotted owls are moderately to highly departed but trending toward reference conditions. Alternative 4 would increase the current rate of treatment, and focus treatments only within the forest/timbered ERUs, through a combination of mechanical and prescribed fire during each 10-year period. However, wildland fire would be limited in its use for treatment in this alternative. In MCW, the forest would treat at least 300 acres using mechanical methods but no more than 20 acres using prescribed fire per 10-year period. In MCD, the forest would treat at least 12,500 acres using mechanical methods, but no more than 2,000 acres using prescribed fire per 10-year period. In PPF, the forest would treat at least 29,230 acres using mechanical methods, but no more than 12,600 acres using prescribed fire per 10-year period.

After 10 years, desired conditions for MCW would move closer to the desired conditions, improving from moderately departed to low departure, changing from 40 percent to 30 percent departure. MCD would remain constant in its moderate departure rating at 55 percent, while PPF would remain highly departed but still moving slightly closer to desired conditions, changing from 79 percent to 77 percent. This would be similar to alternative 1 with a slight improvement for all ERUs that MSO depend on except for MCW, which would change from a moderate departure rating of 40 percent to a low departure rating of 30 percent. While treatments would be focused in these ERUs it appears that not much improvement would be seen as the departure ratings don't appear to show much improvement. This is likely because treatments would be done primarily using mechanical treatments and within the fiscal capacity of the forest. This greatly increases the cost over prescribed fire as well as management of naturally caused ignitions, which this alternative does not allow for.

Vegetation modeling (see Upland Vegetation, Fire Ecology, and Fuels analysis methodology) for alternative 4 estimates that the amount of Ponderosa Pine Forest Gambel Oak subtype available for nesting and roosting would slightly decrease over the next 10 to 15 years from 61 percent to 56 percent (382,202 acres to 350,119 acres). While this may seem negative, consider that in this ERU the desired amount of nest/roost habitat for MSO should be approximately 9 percent (56,725 acres). Mixed Conifer-Frequent Fire nest/roost habitat would also decrease from 55 percent to 47 percent (217,102 acres to 185,285 acres), with the desired amount of nest/roost habitat should be 25 percent (98,893 acres). Mixed Conifer with Aspen nest/roost habitat also decreases slightly from 72 percent to 66 percent (53,106 acres to 49,124 acres), with the desired amount of 93 percent (68,887 acres). For alternative 3, this would be below Desired Conditions for MCW; however, overall there would be an abundance of nest/roost habitat across the forest between all ERUs used for nesting/roosting. Additionally, since the model is not spatial in nature, it will not account for any refugial areas that may not readily burn or may be surrounded by areas treated and fire is not likely, or on steep slopes that may not be treated to conditions that would preclude nesting/roosting. Mechanical treatments in these areas would also be implemented in a way to ensure that they would maintain characteristics required for nesting/roosting and those characteristics would not be lost, as is outlined in the most recent recovery plan.

<u>Determination:</u> There could be some localized adverse impacts to the Mexican spotted owl and its critical habitat by actions in the forest, but overall, species viability would be maintained through this alternative's management activities. Beneficial impacts include improved resiliency of the suitable or potentially suitable nest/roost habitat in the ERUs used by MSO for these activities by reducing fuel loads and returning disturbance regimes toward reference conditions. However, acreage amounts would be lower than alternatives 2 and 5 and as a result improve conditions at a slower rate than either of those alternatives.

Species of Conservation Concern

A species of conservation concern (SCC) is defined by the 2012 planning rule as "a species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area." For many species, essential ecological conditions may be provided for through "coarse filter" plan components such as desired conditions, standards, and guidelines for specific vegetation types. These may be adequate to ensure persistence of those species and maintain viable populations within the Plan area. For other species, "fine-filter" plan components that are species-specific (timing restrictions, etc.) may be required to ensure persistence.

One hundred twelve species met the initial criteria for being identified as a species of conservation concern in the Gila NF. Fifty-five of those species were removed from the list due to one of the following conditions: (1) the species was not known to occur on the forest, or (2) the best available scientific information did not indicate substantial concern for the species to persist in the forest. Fifty-seven species were identified as potential species of conservation concern in the Gila NF (table 26) (see Gila NF Final Assessment for more details).

Table 26. Potential species of conservation concern (SCCs) relevant to the plan area

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)
Amphibians			
Arizona toad	*Anaxyrus microscaphus*	Aquatic	Riparian, PJO, PPE, PPF
Birds			
Gila Woodpecker	*Melanerpes uropygialis*	Large snags, riparian	Riparian with large cottonwood/sycamore
Lewis's Woodpecker	*Melanerpes lewis*	Large snags, riparian	Riparian, PPE, PPF
Fish			
Rio Grande sucker	*Catostomus plebeius*	Aquatic	Riparian
Roundtail (Headwater) Chub	*Gila robusta*	Aquatic	Riparian
Invertebrates			
"Gila" May Fly	*Lachlania dencyanna*	Aquatic	Riparian
A Stonefly	*Capnia caryi*	Aquatic	Riparian
Bearded Mountainsnail	*Oreohelix barbata*	Riparian with deciduous leaf litter in rocks	Riparian
Black Range Mountainsnail	*Oreohelix metcalfei acutidiscus*	Igneous rock, limestone talus or outcrops	Woodland ERUs
Black Range Mountainsnail	*Oreohelix metcalfei hermosensis*	Igneous rock, limestone talus or outcrops	Woodland ERUs
Black Range Woodlandsnail	*Ashmunella cockerelli*	Igneous rock, limestone talus or outcrops	Woodland ERUs
Cockerell Holospira Snail	*Holospira cockerelli*	Igneous rock, limestone talus or outcrops	Woodland ERUs
Gila Springsnail	*Pyrgulopsis gilae*	Cool to warm springs in rhyolite fissures by Gila River	Riparian
Iron Creek Woodlandsnail	*Ashmunella mendax*	Wooded zones of Black Range	PJO, PPE, PPF, MCD, MCW

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)
Marsh Slug Snail	*Deroceras heterura*	Mesic slopes	PPE, PPF, MCD, MCW
Mineral Creek Mountainsnail	*Oreohelix pilsbryi*	Igneous rock, limestone talus or outcrops	Woodland ERUs
Morgan Creek Mountainsnail	*Oreohelix swopei*	Riparian with deciduous leaf litter in rocks	Riparian
New Mexico Hot Springsnail	*Pyrgulopsis thermalis*	Thermal springs along Gila River, aquatic	Riparian
Nitrocris Fritillary Butterfly	*Speyeria nokomis nitocris*	Moist, montane, alpine meadows	SFF
No Common Name Snail	*Ashmunella cockerelli argenticola*	Riparian with deciduous leaf litter in rocks	Riparian
No Common Name Snail	*Ashmunella cockerelli perobtusa*	Igneous rock, limestone talus or outcrops	Woodland ERUs
No Common Name Snail	*Ashmunella tetrodon animorum*	Riparian with deciduous leaf litter in rocks	Riparian
No Common Name Snail	*Ashmunella tetrodon inermis*	Riparian with deciduous leaf litter in rocks	Riparian
No Common Name Snail	*Ashmunella tetrodon mutator*	Riparian with deciduous leaf litter in rocks	Riparian
No Common Name Snail	*Oreohelix metcalfei radiata*	Igneous rock, limestone talus or outcrops	Woodland ERUs
No Common Name (Black Range mountainsnail)	*Oreohelix metcalfei concentrica*	Igneous rock, limestone talus or outcrops	Woodland ERUs
Silver Creek Woodlandsnail	*Ashmunella binneyi*	Rocky outcrops	PPF, MCD
Sonoran Snaggletooth Snail	*Gastrocopta prototypus*	Riparian with deciduous leaf litter in rocks	Riparian
Stonefly	*Taenionema jacobii*	Aquatic	Riparian
Tiger Moth	*Alexicles aspersa*	Unknown	Unknown
Western Bumblebee	*Bombus occidentalis*	Flowering plants	MSG, CPGB, MMS, PJG, PJO, MPO, JUG, PPE, PPF, MCD, MCW, SFF, Riparian
Whitewater Creek Woodlandsnail	*Ashmunella danielsi*	Riparian with deciduous leaf litter in rocks	Riparian
Plants			
Arizona Crested-Coralroot	*Hexalectris arizonica*	Heavy litter in oak, pine, or juniper	PJO, MPO, PPE, PPF
Chiricahua Mountain Mudwort	*Limosella pubiflora*	Sand/mud flats at edges of ponds, lakes or cienegas	Riparian
Cliff Brittlebush	*Apacheria chiricahuensis*	Limestone or rhyolitic rock outcrops 5,500-7,000 ft. elevation	Forested ERUs to 7,000 ft. elevation
Davidson's Cliff Carrot	*Pteryxia davidsonii*	Sheer, rocky north facing cliffs	Woodland ERUs

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)
Gila Morning Glory	*Ipomoea gilana*	Steep slopes (>45%), shallow soils, exposed rhyolitic outcrops	PJO, PPE
Gooding's Onion	*Allium gooddingii*	Under canopy of mixed conifer forest	MCD, MCW, SFF, Riparian
Greene Milkweed	*Asclepias uncialis* ssp. *uncialis*	Grasslands sandy to rocky soils 5,000-7,000 ft. elevation	CPGB, JUG
Heartleaf Groundsel	*Packera cardamine (=Senecio cardamine)*	Understory of mixed conifer and spruce/fir	MCW, SFF
Hess's Fleabane	*Erigeron hessii*	Exposed rock or rocky outcrops	MCW, SFF
Metcalfe's Penstemon	*Penstemon metcalfei*	Cliffs and steep slopes	Riparian
Mimbres Figwort	*Scrophularia macrantha*	North-facing slopes	PJO, PPE, PPF, MCD Riparian
Mogollon Clover	*Trifolium neurophyllum*	Aquatic	PPF, MCD, Riparian
Mogollon Death Camas	*Zigadenus mogollonensis*	Understory of wet mixed conifer and spruce/fir	MCW, SFF
Mogollon Hawkweed	*Hieracium brevipilum (=H. fendleri* var. *mogollense)*	Understory of pine and mixed conifer	PPF, MCD, MCW
Mogollon Mountain Lousewort	*Pedicularis angustifolia*	Mature forest understory	MCW, SFF
Pinos Altos Flame Flower	*Talinum humile*	Rocky south facing slopes over rhyolite	PJO, MPO, PPE
Porsild's Starwort	*Stellaria porsildii*	Understory of mixed conifer	PPF, MCD, MCW
Ray Turner’s Spurge	*Euphorbia rayturneri*	Desert grasslands 4,600-5,600 ft. elevation	SDG, PJO, JUG
Wooton's Hawthorn	*Crataegus wootoniana*	Riparian habitat in montane conifer forest 6,500-8,000 ft. elevation	Riparian
Wright’s catchfly (campion)	*Silene wrightii*	Cliffs and rocky outcrops	Forested ERUs to 8,000 ft. elevation
Wright's Dogweed	*Adenophyllum wrightii* var. *wrightii*	Sandy, silty soils in swales or drainages	PJG, PJO
Yellow Lady's-Slipper	*Cypripedium parviflorum* var. *pubescens*	Mesic meadows and wet streamsides	PPF, MCD, MCW
Mammals			
Arizona Montane Vole	*Microtus montanus arizonensis*	Mesic meadows	PPF, MCD, MCW, Riparian
Gunnison's Prairie Dog (prairie population)	*Cynomys gunnisoni*	Open grasslands and shrublands	MSG, CPGB, PJG, JUG
Lesser Long-nosed Bat	*Leptonycteris curasoae yerbabuenae*	Columnar cacti and agaves	SDG, PJG, PJO, MPO, Riparian

Species Status, Key Ecological Conditions and Threats

Amphibians

Arizona toad (*Anaxyrus microscaphus*) is well distributed in the Gila NF, occurring within the Gila, San Francisco, and Mimbres watersheds in the Gila Region of the Mogollon Rim, with disjunct populations in the Black Range (Ryan et al. 2015). The New Mexico portion of the toads range habitat consists of highly variable riverine habitats that occur at higher elevation than populations in Arizona, Nevada, and Utah (Ryan et al. 2015). Habitat includes rocky stream courses in the pine-oak zone, or stream courses bordered by willows and cottonwoods, irrigation ditches, flooded/irrigated fields, and reservoirs (NatureServe 2016). They may also utilize piñon/juniper woodlands and ponderosa pine forests, but have demonstrated a "strong preference" for associating with lotic systems and appear to be restricted to breeding in slow-flowing and shallow streams (BISON-M 2016). They appear to require clear water conditions with sand or cobble substrates (Ryan et al. 2015). ERUs that may be utilized in the Gila NF include the riparian, shrubland, and woodland ERUs, as well as Ponderosa Pine-Evergreen Oak, and Ponderosa Pine Forest ERUs. All these ERUs are in low to moderate departure, with the exception of Ponderosa Pine Forest ERU that is highly departed. Potential threats to the Arizona toad in New Mexico include climate change, forest fires, hybridization, and the disease chytridiomycosis (Ryan et al. 2015). The disease chytridiomycosis (Bd) has been responsible for many enigmatic amphibian population die-offs and declines (Wake and Vredenburg 2008), and is responsible for declines in some New Mexico species (Ryan et al. 2015). The apparent declines we have observed in the Arizona toad do not necessarily fit the pattern of a Bd outbreak, but other factors such as land-use change or climatic factors appear to be driving declines (Ryan et al. 2015). Additionally, high spring river flow rates can decrease reproductive activity, while drying of sites could exclude potential breeding sites. The reduction in available breeding sites may be the driving factor in the low number of occupied sites we have found over the last three years (Ryan et al. 2015).

There was a positive 90-day finding- July 1, 2015, the USFWS found that "based on our review of the petition and sources cited in the petition, we find that the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted for the Arizona toad (*Anaxyrus microscaphus*) based on Factor E." (USDI FWS 2015d). Factor E warrants listing based on other natural or human-made factors affecting its continued existence. There was substantial evidence showing that genetic integrity/hybridization was the threat that warranted listing. Ryan et al. (2015) found that in the Gila NF specifically, there is no morphological evidence of hybridization between *A. microscaphus* and *A. woodhousii* throughout the Gila Region, and Grant and Sierra Counties, specifically, where the two species co-occur. There have been several large fires in the Gila NF in the past 5 years. The burned uplands likely contribute to increased stream flows and flash flooding events through the range of the species. This species appears to be highly sensitive to increased flow rates, changing water levels, and drying of sites that can decrease reproductive activity. While toads do reproduce in lentic habitats, they are usually not successful (Ryan et al. 2015).

Arizona toad appears to be at risk in the Gila NF because it is sensitive to increased flows, particularly flash flooding events, changing water levels, and drying of sites that could cause reproductive failure. Long-term local population trends and persistence of the species could be at risk if reproductive failure occurs over several consecutive years (Ryan et al. 2015). Until the uplands stabilize from the recent fires, this will continue to be of concern. Additionally, while the short-term population trend in the Ryan et al. (2015) study was stable, there has been an approximate 70 percent decline in the number of occupied Arizona Toad localities (Ryan et al. 2015).

Birds

Gila woodpecker (*Melanerpes uropygialis*) occurs in low elevation, riparian woodlands. Found in the Burro Mountains along the Gila River near Patterson and Pancho Canyons. In New Mexico, the species is confined to lower elevation woodlands, especially those dominated by mature cottonwoods and/or sycamores, along stream courses (Hubbard 1987 as cited in NatureServe 2016, NMDGF 1997 as cited in BISON-M 2016). These habitat types are characterized within the Cottonwood Group of ERUs as described in the Riparian and Aquatic Ecosystem section and are distributed across all local units. These ERUs are moderately departed from reference conditions and approximately 66 percent of these ERUs contain ecological conditions necessary for persistence of the species. Riparian ERUs were not modelled using VDDT, but TEUI documentation suggests these ERUs have a stable trend. Diversions or other flood control practices can alter habitat through changes in the flood disturbance regimes and altered hydrographs necessary for establishment of certain riparian species. Competition with other cavity nesters (NatureServe 2016), particularly European starling, that compete aggressively for excavated cavities and may limit productivity (Kerpez and Smith 1990). The Gila woodpecker are only known from the Gila River Birding Area, and all Breeding Bird Survey regions, except one (Sierra Madre Occidental), show the population is declining (Sauer et al. 2014). Gila woodpecker appears to be at-risk in the Gila NF because the habitat it inhabits is uncommon, habitat is moderately departed from reference conditions, they only appear to inhabit a portion of the available habitat in the Forest, and there is a high uncertainty of the species occurrence in the rest of the forest.

Lewis's woodpecker (*Melanerpes lewis*) occurs in low, riparian woodlands, and in ponderosa pine forests with large trees and open canopy (NMPIF 2007). The species is distributed across the western two-thirds of the Gila NF based on e-Bird (2016) locations. It may use existing holes or natural cavities, or excavate holes in trees that are in an advanced stage of decay. Typically, larger-than-average trees are chosen for nesting (NMPIF 2007). In the lowlands, this species uses habitat types that are characterized within the Cottonwood Group of ERUs as described in the Riparian and Aquatic Ecosystems section and are distributed across all local units.

These ERUs are moderately departed from reference conditions and approximately 66 percent of these ERUs contain ecological conditions necessary for persistence of the species. Riparian ERUs were not modelled using VDDT, but TEUI documentation suggests these ERUs have a stable trend. Diversions or other flood control practices can alter habitat through changes in the flood disturbance regimes and altered hydrographs necessary for establishment of certain riparian species. In Idaho, Saab and Vierling (2001) suggest that cottonwood habitat may be a population sink due to proximity to agricultural lands and increased predation. In the uplands, this species occupies PPE, PPF, and likely MCD ERUs. These ERUs are moderately to highly departed in the Gila NF. These ERUs tend to be overstocked with smaller diameter trees, lacking large diameter trees, which in turn leads to a lack of large diameter snags that this species requires. This has likely caused a reduction in suitable habitat that will likely persist for some time regardless of restoration efforts, as it takes time to grow large trees. There is a long-term population decline for this species and the Breeding Bird Survey routes in the Gila NF also show declining trends (Sauer 2014). Lewis's woodpecker appears to be at-risk in the Gila NF because of their declining population trends, the riparian habitat it uses has been found to be a sink for populations in one study, and the upland ponderosa pine habitat it uses is highly departed and lacks large-diameter snags.

Fish

Rio Grande sucker (*Catostomus plebeius*) habitat includes rocky pools, runs, and riffles of small to medium rivers (Lee et al. 1980, Page and Burr 2011), usually over gravel and/or cobble, but also in backwaters and pools below riffles. This species is rarely found in waters with heavy silt and organic detritus (Sublette et al. 1990). Rio Grande sucker is found in the Mimbres, Gila, and San Francisco River drainages, as well as in Rio Grande drainages east of the Continental Divide on the Black Range. It should be noted that this fish is not native to the San Francisco River drainage and may have been introduced into the Gila River drainage, although it is uncertain (Sublette et al. 1990). A risk rating was developed for several different characteristics in the forest and is detailed in the assessment report (USDA FS Gila NF 2017), including watershed condition, perennial streams, and streamflow. The two watersheds where Rio Grande sucker is present are both determined to be likely high risk for both perennial streams and streamflow, and potential high risk for watershed condition. Of the 10 sub-watersheds in the Gila NF that the Rio Grande sucker is known to be native and occurs or was historically present, they are only currently present in five. Four of those are moderately to highly departed in terms of fish assemblages, while one has low departure. Threats include habitat alteration from water management and flow modifications such as channelization, diversions, fire effects etc., as well as non-native predators and competitors. This is particularly evident in the Mimbres River drainage as there is a large amount of private lands that are allocated water for irrigation, and the 2013 Silver Fire burned in the uplands that may be affecting water flow, ash, etc. The amount of non-native competitors and predators is very high in the Mimbres River drainages that are likely contributing to population declines. Trend is stable in the Rio Grande and Mimbres River drainages (Sublette et al. 1990, NatureServe 2016, IUCN 2016). Overall, short-term trend (less than 10 years) is relatively stable to decline of less than 30 percent, while long-term trend shows a decline of 10 to 50 percent (NatureServe 2016). This species should be considered at-risk in the Gila NF because of the small number of sub-watersheds in which it currently occurs, population declines, non-native species, and watershed conditions after recent wildfires that can affect perennial streams and streamflow.

Roundtail (Headwater) Chub (*Gila robusta*) these chubs along with the Gila chub (*Gila intermedia*) as of April 6, 2017, the Joint Committee on the Names of Fishes concluded that these are all no longer valid species, and all should be considered roundtail chub (*Gila robusta*). A status review on the species will likely be conducted sometime in the future, but for now *G. intermedia* will continue to be analyzed as an endangered species under the Endangered Species Act, while the other two will be analyzed as *G. robusta*.

Roundtail chub was historically considered common in deep pools and eddies of large streams throughout its range in the Upper and Lower Colorado River basins in Wyoming, Utah, Colorado, New Mexico, and Arizona. Today the roundtail chub occupies about 52 percent of its historical range in the Lower Colorado River Basin and is limited to Arizona’s Little Colorado, Bill Williams, Salt, San Carlos and Verde River drainages, Eagle and Aravaipa creeks, and New Mexico’s upper Gila River (USDI FWS 2015b).

Headwater chub historically occur in a number of tributaries of the Verde River, most of the Tonto Creek drainage, much of the San Carlos River drainage, and parts of the upper Gila River in New Mexico (USDI FWS 2015b). It currently persists in all forks of the Gila River, but distribution and numbers have decreased. Habitats in the Gila River containing headwater chubs consist of tributary and mainstem habitats at elevations of 1,325 meters (m) (4,347 feet (ft.)) to 2,000 m (6,562 ft.) (Bestgen 1985; Bestgen and Propst 1989).

Since these two species are now considered one, the habitat and distributions are also combined to represent the totality of conditions for the roundtail chub (*G. robusta*). Habitat includes rocky runs, rapids, and pools of creeks and small to large rivers; also large reservoirs in the upper Colorado River system; generally this species prefers cobble-rubble, sand-cobble, or sand-gravel substrate. It also encompasses middle to headwater reaches of headwaters, creeks, and small rivers (Minckley and DeMarais 2000, Page and Burr 2011). Adults are associated with the largest, most permanent water in streams (Minckley 1981), where a few deep (greater than 1 meter) pools with cover (boulders, woody debris) are intermixed with riffles, runs, and eddies (Bestgen and Propst 1989, Propst 1999). Chubs usually are in pools and runs near cover such as rocks, rootwads, undercuts, or deep water (Bestgen and Propst 1989). Minckley (1973) and Bestgen and Propst (1989) commented that chubs congregate near or in certain pools and are absent in other, similar-type pools. Large populations often occur in pools behind irrigation diversions (Barber and Minckley 1966). In the Gila River Basin, Bestgen and Propst (1989) found headwater chub in water temperatures of up to 26.5 °C and water velocities less than 20 centimeters per second. Threats include changes in flow regimes and stream characteristics from uncharacteristic fire in the uplands, unauthorized use, and competition/predation by non-native aquatic species.

A risk rating was developed for several different characteristics in the forest and is detailed in the assessment report (USDA FS Gila NF 2017), including watershed condition, perennial streams, and streamflow. Of the 13 watersheds in the Gila NF that the roundtail chub is known to be native and occurs or was historically present, they are only currently present in five. Of the five watersheds where roundtail chub is present, three are determined to be likely high risk for stream flow and one likely high risk for perennial streams. They are now only found in 8 sub-watersheds, whereas historically they were present in 29. Five of the 8 sub-watersheds are moderately departed in terms of fish assemblages, while three have low departure. Threats include habitat alteration from water management and flow modifications such as channelization, diversions, fire effects etc., as well as non-native predators and competitors. Trend is stable to declining for the species overall (Sublette et al. 1990, NatureServe 2016). Overall, short-term trend (less than 10 years) is relatively stable to decline of less than 30 percent, while long-term trend shows a decline of 50 to 70 percent (NatureServe 2016). This species should be considered at-risk in the Gila NF because of the decrease in distribution in to the small number of sub-watersheds in which it currently occurs, population declines, non-native species, and watershed conditions after recent wildfires that can affect perennial streams and streamflow.

Invertebrates

"Gila" May fly (*Lachlania dencyanna*) was found in a high gradient, warm, medium river. It has only been found at junction of East Fork and mainstem Gila River clinging to woody debris. The area it was located was characterized as a warm, unshaded, turbid, and rapid stream. Specific threats are generally unknown, but likely anything that would affect other macroinvertebrates such as diversions or other de-watering of streams, reducing dissolved oxygen, pollution, or increased sediments could be considered threats. Distribution appears to be limited to the Gila River drainage in New Mexico and is the only endemic mayfly in New Mexico (McCafferty et al. 1997). Authors made no notes on abundance or trend, but felt that the Gila River drainage may be a refugium for this as well as other southwest species (McCafferty et al. 1997). This species should be considered at-risk in the Gila NF because of its restricted distribution, the proposed Gila River Diversion Project, large wildfires in the uplands, and it is identified as globally "critically imperiled" (G1) in NatureServe.

A Stonefly (*Capnia caryi*) was found in Iron Creek in the Gila NF in a clear, cool stream with scattered boulders and a mixture of cobble with gravels, and low (less than 3 percent) gradient. The species is only known from 2 tiny creeks; one in Arizona (Mamie Creek at Escudilla Mtn.) and the other in New Mexico (Upper Iron Creek, Catron Co). This species was only discovered in New Mexico in February 1999, with another specimen found in March 2001 in Arizona, and recently described as a new species by Bauman and Jacobi (2002). Specific threats are not known, but likely, anything that may affect other macroinvertebrates such as diversions or de-watering of streams, reducing dissolved oxygen, pollution, or increasing sediments could be considered threats. In the Gila NF, it appears to be limited in its distribution to Upper Iron Creek, which is a small tributary of the Middle Fork Gila River. The authors only found and described less than 15 specimens, so it is likely not very abundant where it does occur. This species should be considered at-risk in the Gila NF because of its restricted distribution, large wildfires in the uplands, and it is identified as globally "critically imperiled" (G1) in NatureServe.

Stonefly (*Taenionema jacobii*) occurs in Gila River watershed where it was examined from larvae collected in Cherry Creek (Stewart 2009). The species has been found in the Gila River watershed into Arizona as well (NatureServe 2016). Specific threats are not known, but likely anything that may affect other macroinvertebrates such as diversions or de-watering of streams, reducing dissolved oxygen, pollution, or increasing sediments could be considered threats. In New Mexico, the species is known from less than 10 occurrences (NatureServe 2016), so it is likely not very abundant, and there is no trend data available for this species. This species should be considered at-risk in the Gila NF because of its restricted distribution, large wildfires in the uplands, and it is identified as globally "imperiled" (G2) in NatureServe.

Silver Creek woodlandsnail (*Ashmunella binneyi*) occurs in the upper ends of Silver, Bull Top, and Spring Canyons in Black Range between 8,000 and 8,500 feet elevation. It has a limited distribution of approximately 2 miles north to south and occurs in ponderosa pine and Douglas-fir at the heads of these canyons. The Ponderosa Pine Forest (PPF) and Mixed Conifer-Frequent Fire (MCD) ERUs are highly departed across the Gila NF (USDA FS Gila NF 2017), and often burn in a way that is not within its historic range of variability. The 2013 Silver Fire burned with high-intensity through all the canyons in which this species was known. Little is known about habitat needs other than it occurs in rocks at the upper ends of the canyons mentioned above. The effects of fire to the species are not known, but they do occur within fire-adapted ecosystems, and likely evolved in the presence of fire. The high departure of these systems may not have exposed them historically to effects of higher severity fire. Threats may include uncharacteristic wildfire or any ground disturbing activities such as mining or road construction and/or maintenance; however, the terrain where this species occurs is very rugged and mostly inaccessible, so mining and road construction are not likely to occur. Metcalfe and Smartt (1997) only mention this species as being less abundant than *A. mendax*, which has a broader distribution and is described as being "quite abundant." Trend appeared to be relatively stable prior to the fire as the species was found in the mid-1990s in the same areas it was originally described at the turn of the 20th century. This species should be considered at-risk in the Gila NF because of its restricted distribution, the 2013 Silver Fire burned all known locations of this species, and it is identified as globally and taxonomically "critically imperiled" (G1/T1) in NatureServe.

No Common Name (*Ashmunella cockerelli argenticola*) and **Morgan Creek mountainsnail (*Oreohelix swopei*)** *A. c. argenticola* has been found in flourishing colonies along NFS Road 523 where it crosses Silver Creek Canyon and farther north where it crosses Rustlers Canyon (a tributary or Silver Creek Canyon). It is found in the higher elevations where habitat is more mesic on rocks in deciduous leaf litter near creeks (Metcalf and Smartt 1997). *O. swopei* is found in canyons of northern Black Range, Turkey Run, head of Morgan Cr., Diamond Cr., and Black Canyon, both eastern and western slopes. These canyons are all mesic canyons with flowing water and riparian leaf litter among rock. Threats for both species include uncharacteristic wildfire, flooding, and any disturbances that may impact canyon bottoms and leaf litter covering rocks. The 2013 Silver Fire burned through all the canyons *A. c. argenticola* was known, as well as the uplands that feed Silver Creek and Rustlers Canyons. This will likely increase the intensity of water flow events throughout these canyons. Abundance for *A. c. argenticola* is described by Metcalfe and Smartt (1997) as being found in "flourishing colonies" in both Silver Creek and Rustlers Canyons. *O. swopei* was described as "not abundant nor easy to find" by Metcalfe and Smartt (1997). Trend for these species appeared to be relatively stable prior to the fire as these species were found in the mid-1990s in the same areas they were originally described at the turn of the 20th century. These species should be considered at-risk in the Gila NF because of their restricted distribution, the 2013 Silver Fire burned all known locations of *A. c. argenticola*, and they are identified as globally "critically imperiled" (G1) in NatureServe.

Black Range woodlandsnail (*Ashmunella cockerelli cockerelli*), No Common Name (*Ashmunella cockerelli perobtusa*), Cockerell Holospira snail (*Holospira cockerelli*), Black Range mountainsnail (*Oreohelix metcalfei acutidiscus*), No Common Name (Black Range mountainsnail), (*Oreohelix metcalfei concentrica*), Black Range mountainsnail (*Oreohelix metcalfei hermosensis*), No Common Name (*Oreohelix metcalfei radiata*), and **Mineral Creek mountainsnail (*Oreohelix pilsbryi*)** are all species that occur on the Black Range and whose habitat is described as talus of igneous rock, limestone talus or other calcareous rock, or limestone bedrock or outcrops. Also, all these species occur within the same range of woodland ERUs that are all moderately departed in the Black Range local area (USDA FS Gila NF 2017). These ERUs tend to have longer fire return intervals than Ponderosa Pine Forest or Mixed Conifer-Frequent Fire and tend to have fires burn that are of mixed-severity. The effects of fire to the species are not known, but they do occur within fire-adapted ecosystems and likely evolved in the presence of fire. The 2013 Silver Fire burned through the known locations for all these species except *H. cockerelli*, *O. m. hermosensis*, and *O. pilsbryi*, although many of the areas within these woodlands burned with a low to mixed-severity. Additional threats may include any ground disturbing activities that would affect any of the rock formations mentioned above. The terrain where these species occur is very rugged and mostly inaccessible, so mining and road construction are not likely to occur. Distribution of these species is quite limited, often only known from one canyon, although some are described as being quite abundant where they do occur. Trend for these species appeared to be relatively stable prior to the fire as they were found in the mid-1990s where they were originally described at the turn of the 20th century. These species should be considered at-risk in the Gila NF because of their restricted distribution, the 2013 Silver Fire burned all known locations of many of these species increasing the risk for severe flooding, and they are identified as globally or taxonomically "critically imperiled" (G1/T1) or globally or taxonomically "imperiled" (G2/T2) in NatureServe.

Whitewater Creek woodlandsnail (*Ashmunella danielsi*), No Common Name (*Ashmunella tetrodon inermis*), No Common Name (*Ashmunella tetrodon mutator*), No Common Name (*Ashmunella tetrodon animorum*), Sonoran snaggletooth snail (*Gastrocopta prototypus*), and **Bearded mountainsnail (*Oreohelix barbata*)** are all species that occur in canyon bottoms in riparian areas near creeks or springs in the Mogollon Mountains and the Black Range. Habitat for these species consists of igneous rock in talus on moist northern slopes, moss covered in places, and damp leaf litter in interstices, or deep canyons with riparian areas where deciduous trees produce an abundant leaf litter where snails occur under and around stones and logs. They occur from Dry Creek Canyon in the southwest Mogollon Mountains to Whitewater Creek Canyon and Willow Creek Canyon. *G. prototypus* is also found in the West Fork Gila River and fossils have been found in Trujillo Canyon in the Black Range and off NFS lands. Likely this species occurs in other ranges in southwestern New Mexico (Metcalf and Smartt 1997). *A. t. animorum* was only found at Holden Spring in the Black Range. All of the *A. tetrodon* subspecies need further study to determine if they are truly subspecies or all individual species (Metcalfe and Smartt 1997). The 2012 Whitewater Baldy and 2013 Silver Fires burned known locations or the uplands that drain into the creeks where these species occur in the Gila NF. This will likely increase the intensity of water flow events throughout these canyons and dry out the areas some species were found. Additional threats to these species may include flooding, or any other activities that could impact stream courses. No mention of these species abundance is mentioned, but their distribution is limited to only a few known canyons. Trend for these species appeared to be relatively stable prior to the fires as they were found in the mid-1990s where they were originally described at the turn of the 20th century. These species should be considered at-risk in the Gila NF because of their restricted distribution, the 2012 Whitewater Baldy and 2013 Silver Fires burned known locations and much of the uplands of many of these species increasing the risk of severe flooding, and they are identified as globally or taxonomically "critically imperiled" (G1/T1) or globally or taxonomically "imperiled" (G2/T2) in NatureServe.

Iron Creek woodlandsnail (*Ashmunella mendax*) occurs in wooded canyons at lower elevations but it is more widespread in wooded zones of higher elevations in the Black Range. It has been found from the town of Kingston on the east side of the Black Range crest, all the way to Gallinas Canyon on the west side of the crest. It is abundant where found and wide ranging in elevation from 5,500 to 9,000 feet (Metcalfe and Smartt 1997). It occurs from piñon-juniper woodlands all the way up to moist mixed conifer forests. Woodland, Mixed Conifer-Frequent Fire forest, and Mixed Conifer with Aspen forest ERUs are moderately departed (USDA FS Gila NF 2017) in the Black Range local area, but the Ponderosa Pine Forest ERU is highly departed and likely to experience a higher fire severity than historically occurred. The upper elevations where this species occurs was burned in the 2013 Silver Fire. Effects from fire are unknown for this species, but the Ponderosa Pine Forest ERU it occurs in likely experienced severe fire effects. Additional threats may include, increased effects due to flooding from the burned vegetation in the uplands, timber harvest, or other activities that would affect wooded canyons. Harvest activities are unlikely because of the steep, inaccessible terrain along the Black Range crest. Trend for this species appeared to be relatively stable prior to the fire as was found in the mid-1990s where it was originally described at the turn of the 20th century. This species should be considered at-risk in the Gila NF because of its restricted distribution, the 2013 Silver Fire burned approximately half of this species' fairly restricted range, and it is identified as globally and taxonomically "critically imperiled" (G1/T1) in NatureServe.

Marsh slug snail (*Deroceras heterura*) is endemic to Willow Creek in the Mogollon Mountains and from Sawyers Peak north to Morgan Creek (more than 20 miles as crow flies) Black Range, but appears to be widespread, and it occurs above 8,000 feet elevation. It occurs from ponderosa pine to moist mixed conifer forests (Metcalfe and Smartt 1997). Ponderosa Pine Forest ERU is highly departed in the Gila NF, while the Mixed Conifer-Frequent Fire and Mixed Conifer with Aspen ERUs are moderately departed (USDA FS Gila NF 2017). Much, if not all of the areas this species has been described as occupying has burned, either in the 2012 Whitewater-Baldy or 2013 Silver Fires. It appears this species requires more mesic habitats that may experience a drying trend because of the large fires. Additional threats may include timber harvest, road construction, or any other ground disturbing activities in these vegetation types. Much of the area this species occurs is wilderness area and/or very rugged terrain, thereby eliminating most threats to the species. No information was found about this species abundance or trend, and no efforts have been made to re-locate the species since originally being described by Pilsbry in the mid-1940s (Metcalfe and Smartt 1997). This species should be considered at-risk in the Gila NF because of its restricted distribution, the 2012 Whitewater Baldy and 2013 Silver Fire burned most, if not all, of this species fairly restricted range, it is identified as globally and taxonomically "critically imperiled" (G1/T1) in NatureServe, and there is a high uncertainty of the species occurrence on the rest of the forest.

Gila springsnail (*Pyrgulopsis gilae*) occurs in cool to warm springs in rhyolite fissures adjacent to the Gila River. The species is common within cool water springs within its range. There are 1,807 known seeps and springs on the plan area, with 51 percent of those occurring on Forest Service lands (USDA FS Gila NF 2017). It is possible this species occurs in locations that are not on Forest Service lands that have had no survey. It is known from the East Fork, Middle Fork, and Mainstem Gila River, as well as tributaries forming the East Fork (Beaver, Taylor, Whitetail, and Whitewater Creeks). Gila springsnail is relatively well distributed in the Gila River Drainage. USFWS determined listing of the species was not warranted after additional survey attempts yielded several additional locations of the species. Threats include habitat modification from water diversion, drying of springs/creeks, livestock trampling, and wetland habitat loss (NatureServe 2016, BISON-M 2016). The areas the Gila springsnail occupies already offer protections because other listed species occur in the same locations that also benefit this species. The short-term trend of this species is relatively stable (less than 10 percent change) (NatureServe 2016), and current management already offers some protections that would benefit this species. Long-term trend for this species is unknown (NatureServe 2016). This species should be considered at-risk in the Gila NF because it is identified as globally "imperiled" (G2) in NatureServe.

New Mexico hot springsnail (*Pyrgulopsis thermalis*) this species inhabits thermal waters (91 to 100 degrees F) issuing from multiple sources along a vertical cliff feature along the Gila River. Principal outflows are generally too hot for the snail, so they occur in cooler portions of the outflows. While seeps and springs have been mapped and assessed in the 2017 Final Assessment Report, it does not separate springs by warm or cold springs. Species occurs along a 3-mile stretch of the lower East Fork Gila River and another population 1.5 miles below the confluence of the East and West Forks Gila River (NatureServe 2016). Threats include habitat degradation from recreational bathing and water pollution/contaminants. The species only occurs within wilderness areas that may afford it some protection. It is only known from two sites, and threats are potentially affecting both. One from recreational bathing and unauthorized digging/diverting water, and the other from water diversions on private land. The short-term trend is relatively stable (less than 10 percent change), while the long-term trend is unknown (NatureServe 2016). This species should be considered at-risk in the Gila NF because both known populations are potentially being impacted by human disturbance, and it is identified as globally "imperiled" (G1) in NatureServe.

Nitrocris fritillary butterfly (*Speyeria nokomis nitocris*) is limited to moist, montane meadows and occurs in alpine meadows in the Gila NF (Zimmerman 2001). The historic population known from the confluence of Little Creek and the Gila River was surveyed for and not found in 2000. Willow Creek campground is the only known extant population in the Gila NF, and it appears to hold fewer numbers than in years past (Zimmerman 2001). Threats may include Willow Creek campground development, collection, overgrazing, or any disturbance that reduces or eliminates *Viola nephrophylla* (Zimmerman 2001). Much of the Spruce-Fir Forest ERU this butterfly occupies has been burned by wildfire in the last 5 years, is very departed, and it is modelled to worsen in the future. This ERU historically experienced high-severity, stand-replacement fire; however, not likely at the scale it has seen in recent years (USDA FS Gila NF 2017). This species should be considered at-risk in the Gila NF because there is only one extant site, numbers appear to be declining, and it is located in a high recreational use area.

Tiger moth (*Alexicles aspersa*) - *Alexicles* is known from extreme NE Arizona and NW New Mexico. Details of its distribution in New Mexico is not recorded. Its life history and habitat requirements are not known. *Alexicles aspersa* was probably added to the NM list because of its limited distribution in New Mexico in habitats that are generally inaccessible because the lands are in Tribal Reservations (Metzler 2014). Two historical sightings are documented in southwestern New Mexico, one in Grant Co. and one in Sierra Co., but no specific locations were given (BugGuide 2016), so it is unknown if locations were in the Gila NF. This species life history and ecology are unknown, but it has been raised on dandelion and lettuce leaves in captivity (NatureServe 2016). Because nothing is known of *A. aspersa*'s life history or habitat requirements, it is not possible to identify any specific threats (Metzler 2014). This species should be considered at-risk in the Gila NF because it is identified as globally "imperiled" (G2) in NatureServe.

Western bumblebee (*Bombus occidentalis occidentalis*) has been collected in the Gila NF along the Bursum Road in 1961. The habitat for this species is described as open grassy areas, urban parks and gardens, chaparral and shrub areas, and mountain meadows (Williams et al. 2014, as cited in NatureServe 2018). Bumblebees, including *B. occidentalis*, are generalist foragers and have been reported visiting a wide variety of flowering plants (Hatfield et al. 2015). Rangewide, example food plants of *Bombus occidentalis* include *Ceanothus sp., Centaurea sp.*, *Chrysothamnus sp.*, *Cirsium sp.*, *Geranium sp.*, *Grindellia sp.*, *Lupinus sp.*, *Melilotus sp.*, *Monardella sp.*, *Rubus sp.*, *Solidago sp.,* and *Trifolium sp.* (Williams et al. 2014, as cited in NatureServe 2018). Prior to 1998, the western bumblebee was both common and widespread throughout the western United States and western Canada. The U.S. states included in the former range of this species are northern California, Oregon, Washington, Alaska, Idaho, Montana, western Nebraska, western North Dakota, western South Dakota, Wyoming, Utah, Colorado, northern Arizona, and New Mexico. Since 1998, this bumblebee has undergone a drastic decline throughout some areas of its former range. While viable populations still exist in Alaska and east of the Cascades in the Canadian and U.S. Rocky Mountains, the once common populations of central California, Oregon, Washington and southern British Columbia have largely disappeared (Xerces Society 2016). The Gila NF appears to be the southern periphery of the bumblebees range. There has been a positive 90-day finding by the USFWS that listing of this species may be warranted (USDI FWS 2016b). This species should be considered at-risk in the Gila NF because it is identified as taxonomically "imperiled" (T2) in NatureServe.

Plants

Wright's dogweed (*Adenophyllum wrightii* var. *wrightii*) occurs in piñon/juniper woodland, in sandy or silty soils in swales or drainages. The Piñon-Juniper Woodland and Piñon-Juniper Grass Woodland ERUs have a low to moderate departure across the Gila NF (USDA FS Gila NF 2017). In the Gila NF, it is found from near the town of Fierro at the south end of the forest, north and east to HWY 59, north of the town of Winston. Threats to this species are not well known, but may include unauthorized use and possibly spraying for unwanted weeds. In some areas of Mexico, it grows in abundance and it is treated as a weed (NMRPTC 1999). The species appears to be fairly well distributed in the Gila NF and it occurs within ERUs that have low to moderate departure. Populations in New Mexico were reported as "healthy and reproducing normally" (NMRPTC 1999). Range was expanded during the abnormally wet summer of 2006 when numerous populations of the plant were discovered. Additional surveys during wet summers may further extend this species range into other mountain ranges in New Mexico (NMRPTC 1999). The NMRPTC (1999) now considers this species common within its range in New Mexico. Because of the increase in the number of populations of this species, the trend is thought to be increasing. This species should be considered at-risk in the Gila NF because it is identified as globally "critically imperiled" (G1?) in NatureServe.

Gooding's onion (*Allium gooddingii*) occurs in spruce-fir forest, mixed conifer with aspen from 6,500 to 9,400 feet. Mixed Conifer with Aspen and Spruce-Fir Forest ERUs are moderately to highly departed in the Gila NF, and spruce-fir forest is modelled to get worse into the future (USDA FS Gila NF 2017). This is likely because the majority of this ERU burned in the last 5 years with high severity. While the spruce-fir ERU historically burned on a 150- to 400-year cycle with mixed-severity to stand-replacement fire, the mean patch size of the disturbances was historically 200 to 1,000 acres (USDA FS Gila NF 2017). A total of 28 out of 30 known occupied sites have been burned by wildfires since 2006, with 21 of them 30 burning during the Whitewater Baldy fire in 2012 (Roth 2016). Surveys post-fire found the species was present even in areas that burned with high severity. Surveys by Roth (2016) show that the plant is able to survive direct effects of fire, but likely will not persist in post-fire environment as evidenced by disappearance of a known population consisting of thousands of plants within the 2006 Bear Fire. This species is adapted to growing under the canopy of mixed conifer forests (Roth 2016), therefore, it is likely that it persisted historically even though the ERUs it occurs in burn typically with severe conditions. The extent of fires that burned historically were not likely as broad as the most recent fires, which could affect persistence with fewer sites that are considered suitable. This species occurs from Freiborn Canyon, north of Eagle Peak in Long Canyon, south to Willow Creek Campground. Additional threats include impacts from flooding in the post-fire erosion events (Roth 2016), collection, grazing, logging, but it has been known to return following disturbance (NatureServe 2016). Results from Roth (2016) surveys show that abundance may have decreased, and the trend appears to be declining. This species should be considered at-risk in the Gila NF because approximately 93 percent of existing sites have burned within the last 10 years, ERUs this species occurs in are moderately and highly departed and not modelled to improve in the future, and both abundance and trend appear to be declining in the Gila NF.

Cliff brittlebush (*Apacheria chiricahuensis*) occurs in areas containing bare rock/talus/scree/cliff, such as limestone or rhyolitic rock outcrops in Rocky Mountain montane conifer forests between 5,500-7,000 feet elevation (NMRPTC 1999). In the Gila NF, it is found in Running Water Canyon, a tributary to Diamond Creek, in the Aldo Leopold Wilderness area. Mineral exploration and development are identified threats that could possibly affect some populations. However, in the Gila NF, the cliff habitat in which the species occurs effectively removes threats to this species as it occurs in a wilderness area where mining is withdrawn. Although it has only been found in one canyon in the Gila NF, it is likely undersurveyed as the areas it inhabits are very inaccessible. The geologic formations necessary for the species are likely in low departure from reference conditions. No information on abundance has been noted in the Gila NF specifically, but it is reported to be common and abundant in suitable habitat in the San Mateo and Animas Mountains (NMRPTC 1999) which the Gila NF falls right in between both. Trend is not described for the species either, but given the habitat in which it occurs, it is likely stable. This species should be considered at-risk in the Gila NF because it is only known from one canyon in the forest, and it is identified as globally “imperiled” (G2) in NatureServe.

Greene milkweed (*Asclepias uncialis* ssp. *uncialis*) occurs in grasslands, on sandy to rocky soils and within an elevational range of 5,000 to 7,000 feet. In the Gila NF, it has only been found in one location approximately 1/4 mile from New Mexico/Arizona border (6 plants). The location where this population is mapped puts the species within the Colorado Plateau/Great Basin Grassland ERU, but it may potentially occur within the Juniper Grass Woodland ERU where they intergrade. The Colorado Plateau/Great Basin Grassland ERU is highly departed, while the Juniper Grass Woodland ERU is in low to moderate departure across the Gila NF, and they are not modelled to improve in the future (USDA FS Gila NF 2017). Identified threats to the species include residential development (particularly in Arizona), agriculture, and livestock operations. The trend over the last 100 years is not well known, but it is likely declining (NatureServe 2016). This species should be considered at-risk in the Gila NF because it is only known from one population of 6 plants in the forest, it occurs within an ERU that is highly departed and not modelled to improve into the future, and it is identified as taxonomically "imperiled" (T2) in NatureServe.

Wooton's hawthorn (*Crataegus wootoniana*) occurs in riparian habitat in montane conifer forest at an elevational range of 6,500 to 8,000 feet. Riparian ERUs are in low to moderate departure in the Gila NF (USDA FS Gila NF 2017). The species is distributed from the head of Little Creek off of the West Fork Gila River, south to Silver City. This species has been infrequently described in the Gila NF historically, with no documentation on abundance (NatureServe 2016). It is likely this species is not very abundant in the Gila NF because of this. Identified threats may include drought, climate change, timber harvest activities, possibly riparian disturbances, and wildfire effects. Because this species has been described infrequently with little work being done on it, little is known about the abundance and trend of the species. This species has not been specifically surveyed for, but it has been documented on the forest and continuously documented in certain areas, so the trend may be stable. This species should be considered at-risk in the Gila NF because it is identified as globally "imperiled" (G2) in NatureServe.

Yellow lady's-slipper (*Cypripedium parviflorum* var. *pubescens*) occurs in mesic meadows in ponderosa pine and mixed conifer forests, and wet areas along streams. Much of the ERUs (Ponderosa Pine Forest, Mixed Conifer-Frequent Fire, and Mixed Conifer with Aspen) this plant occurs in, including both known populations, have been burned in the last 5 years, and these ERUs are very departed and modelled to worsen in the future (USDA FS Gila NF 2017). The species also appears to prefer growing in acidic soils. The species has only been documented at two sites in the Gila NF (Little Creek Box, and Little Turkey Creek) in 1978 and 1966, respectively, but no collections or surveyors named (Natural Heritage NM 2015). The Gila NF appears to be on the very periphery of the species range. Both known locations likely burned in the Dry Lakes Fire in 2003, and the Miller Fire in 2011, but the severity of the fires in the occupied sites is not known. No known attempts have been made to relocate the historic plant locations, so abundance and trend of the species in the Gila NF is not known. Identified threats include plant collection and habitat loss/degradation (NMRPTC 1999). There has been a range-wide decline of the species of 10 to 30 percent (NatureServe 2016). This species should be considered at-risk in the Gila NF because the ERUs in which it occurs are moderately to highly departed, the species is only known from two sites that are isolated from any other known plants, and the two known sites have both burned in wildfires.

Hess's fleabane (*Erigeron hessii*) occurs in mixed conifer or sub-alpine forest at an elevational range of 9,500 to 10,200 feet. This species is a very narrow endemic with three sites documented near Whitewater Baldy. The species occurs exclusively and is dependent upon exposed rock or rocky outcrops (NMRPTC 1999). All three sites of this species occurred within the 2012 Whitewater-Baldy Fire perimeter, but it is not likely impacted or possibly even positively impacted by the fire. Also, it is experiencing few, if any, alterations to its habitat from direct impacts of the fire or post-fire impacts (Roth 2016). Exposed rock and cliff habitat where this species grows has not been altered and is likely in low departure from reference conditions. The fact that the species occurs in wilderness areas, offers protections from most threats to the species. One site had approximately 100 plants in full to late flowering stage on a rock outcrop during a 2013 survey of the known sites (Roth 2016). No surveys or studies have been conducted on this species, so trend is unknown but likely stable as they occur and persist in the known historic locations. This species is expected to persist into the future (Roth 2016). This species should be considered at-risk in the Gila NF because it is identified as globally "critically imperiled" (G1) in NatureServe.

Ray Turner's spurge (*Euphorbia rayturneri*) occurs in desert grasslands from 4,600 to 5,600 feet elevation (NMRPTC 1999, NatureServe 2018) in sandy, moist soils (Gila Flora 2018). This plant has only been found to occur in Juniper Grass Woodland as mapped in the Gila NF, but in close proximity to Piñon-Juniper Woodland, Semi-Desert Grassland, and Desert Willow Riparian. Juniper Grass Woodland, Piñon-Juniper Woodland and Desert Willow Riparian are in low to moderate departure, while Semi-Desert Grassland is highly departed and all ERUs are modelled to remain stable in the future (USDA FS Gila NF 2017). This species is found in one location in the Gila NF in Gold Gulch in the Burro Mountains. More work needed to determine effects from management activities, as well as determining abundance and specific habitat requirements. This species should be considered at-risk in the Gila NF, because it is only found in one location and identified as globally "critically imperiled" (G1) in NatureServe.

Arizona crested-coralroot (*Hexalectris arizonica*) occurs in heavy litter in oak, pine, or juniper woodlands in mesic to dry soils, often in limestone from 5,000 to 7,000 feet elevation (NMRPTC 1999, SEINet 2018). The ERUs this species may occur within (Piñon-Juniper Woodland, Madrean Piñon-Oak Woodland, and Ponderosa Pine-Evergreen Oak) are in low to moderate departure and modelled to remain stable in the future. One ERU (Ponderosa Pine Forest) is highly departed and modelled to remain so in the future (USDA FS Gila NF 2017). This species has been found in one location in the Gila NF in the canyon bottom of Middle Percha Creek, 1.7 miles west of the village of Kingston, New Mexico. The area where this species was found has seen heavy flooding and the canyon bottom has seen heavy scouring from the flood waters. There is a forest access road in the canyon bottom that has been reconstructed post flood as well. More survey work is needed to determine abundance, distribution, and specific habitat requirements, as current distribution and abundance is not currently known. This species should be considered at-risk in the Gila NF, because it is not known to occur elsewhere in the forest, and the only known location for this species has been altered by post-fire flooding and management activities.

Mogollon Hawkweed (*Hieracium brevipilum* (=*H. fendleri* var. *mogollense*)) occurs in ponderosa pine to mixed conifer forests from 8,200 to 10,500 feet elevation (NMRPTC 1999). Much of the ERUs (Ponderosa Pine Forest, Mixed Conifer-Frequent Fire, and Mixed Conifer with Aspen) this plant occurs in are moderately to highly departed and modelled to worsen in the future (USDA FS Gila NF 2017). This species is found from near Mogollon Baldy, north to Willow Creek. More work needed to determine effects from logging, as well as determining abundance and habitat requirements, but the species appears to respond positively to disturbance from fires. This species occurs within the 2012 Whitewater-Baldy Fire perimeter and it is not likely impacted or possibly even positively impacted by the fire, and it is experiencing few, if any, alterations to its habitat from direct impacts of the fire or post-fire impacts (Roth 2016). This species is known from wilderness areas that provide protections from most management activities. Surveys for this species were conducted after the 2012 Whitewater Baldy Fire and they were found to be highly localized, but abundant where they occurred, ranging from 50 to thousands of plants at each site (Roth 2016). Previously undocumented sites were also located during this survey, and it is felt that additional surveys in suitable habitat would likely document additional currently unknown populations. Since surveys by Roth (2016) located historic populations and identified new ones, the trend appears to be stable to slightly increasing. This species is expected to persist into the future (Roth 2016). This species should be considered at-risk in the Gila NF because it is identified as taxonomically "imperiled" (T2) in NatureServe.

Gila morning glory (*Ipomoea gilana*) occurs in open woodlands of pinon, juniper, and evergreen oak on southern to eastern slopes, and known solely from mid-elevations (6,600 to 6,700 feet) of the Black Range on the eastern edge of the Gila NF of southwestern New Mexico. The surrounding topography of the area where they have been located consists of a landscape featuring steep slopes (greater than 45 percent) with shallow soils and exposed rhyolitic outcrops. The first author estimates less than 300 individual plants within 3.5 kilometers of each other (Keith et al. 2017). The area that has been described appears to be the only known location of this plant as it has been newly discovered. Trend for the species is not known at this time and with approximately 300 individuals or less, abundance is low. While specific habitat needs are not entirely known at this time, the habitat this plant occurs within is plentiful (1,245,651 acres) and in moderate departure and is modeled to remain so in the future. Risks to the species are also not known as it has only recently been discovered. However, risks from management activities in this area would tend to be very low as plants are on steeper slopes with shallow soils and exposed outcrops. This would reduce the potential effects of any fuelwood cutting or timber harvest using either manual or mechanical methods, and livestock would likely avoid the area as the shallow rhyolitic soils and exposed outcrops would have minimal forage. The Silver Fire of 2013 did not reach the area where this plant was found as this area is broken and rocky terrain with not enough fuels to carry the fire into the area. The plant was found at the end of a prolonged drought period, so it is not known how drought or a changing climate may or may not affect this species. There are no management activities proposed anywhere near this area, as priorities for the district have been identified elsewhere for the next 10 to 20 years. This species should be considered at-risk in the Gila NF because there is only one location that it is known to occur, and it is identified as globally "imperiled" (G1G2) in NatureServe.

Chiricahua mountain mudwort (*Limosella pubiflora*) occurs in wet sand and mud flats at the edges of ponds, lakes, or cienegas (NMRPTC 1999, SEINet 2018, NatureServe 2018). It requires surface water for its survival and appears to do well where the slope is essentially level (NatureServe 2018 as described by Malusa and Warren 1994). Populations of this species have been found at the edges of cattle tanks in New Mexico where they have not appeared to suffer (NMRPTC 1999). This species has only been found in the mud flats adjacent to the boat ramp at Quemado Lake. It has not been found in any of the areas it was originally described in the Animas Valley in 1973 where it was last found during surveys in 1991. It was thought to not occur in New Mexico anymore (NatureServe 2018) until it was found at Quemado Lake in 2009 (SEINet 2018). This appears to be the only known location in New Mexico at this time. Overall, trend for this species has been in decline as it has not been found in other areas it has been originally described. This species should be considered at-risk in the Gila NF because it is only found at a single location in the forest, is the only known location it is present in New Mexico, and it is identified as globally "critically imperiled" (G1Q) in NatureServe.

Heartleaf groundsel (*Packera cardamine* (=*Senecio cardamine*)) occurs in mixed conifer with aspen and spruce-fir forest, typically above 8,000 feet elevation (Roth 2016). It is generally associated with Douglas-fir (*Pseudotsuga menziesii*), white fir (*Abies concolor*), Mountain spray (*Holodiscus dumosus*), aspen (*Populous tremuloides*), alpine woodsorrel (*Oxalis alpina*), wild geranium (*Geranium* sp.), nodding ragwort (*Senecio bigelovii*), and Canadian violet (*Viola canadensis*) (Roth 2016). These ERUs are at moderate to high departure from reference conditions in the Gila NF and not modelled to improve over time (USDA FS Gila NF 2017). Populations of this plant are distributed around Willow Mountain, just northwest of Whitewater-Baldy. Likely threats include drying out of sites because of timber harvest or forest fire. Many populations are on steep, inaccessible slopes (NMRPTC 1999, Roth 2016), but most populations likely burned in the 2012 Whitewater-Baldy Fire. While the Spruce-Fir Forest ERU historically burned on a 150- to 400-year cycle with mixed-severity to stand-replacement fire, the mean patch size of the disturbances was historically 200-1,000 acres (USDA FS Gila NF 2017). This species is adapted to growing under the canopy of mixed conifer forests (Roth 2016); therefore, it is likely that it persisted historically even though the ERUs it occurs in burn typically with severe conditions. The extent of fires that burned historically were not likely as broad as the most recent fires, which could affect persistence with fewer sites that are considered suitable. This species still occupied the general areas and habitat from where they were documented prior to the 2012 fire. Surveys conducted by Roth (2016) showed that plants were found in groupings of a few plants to thousands of plants, well past flowering stage. It can be assumed that these rare plants generally survive the direct impacts of fires, regardless of fire severity (Roth 2016). However, long-term impacts of radical habitat alteration caused by severe fires may ultimately cause the decline or even disappearance of several species from their current occupied habitats (Roth 2016). This species should be considered at-risk in the Gila NF because all but one existing site has burned within the last 5 years, and ERUs this species occurs in are moderately and highly departed and not modelled to improve in the future.

Mogollon mountain lousewort (*Pedicularis angustifolia*) occurs in mature forests in Catron County between 7,000 and 9,000 feet elevation (NatureServe 2016). It has been found in mixed-conifer and spruce-fir forests on mature forest floors (SEINet 2016). This species has been found in mixed-conifer with aspen, and Spruce-Fir Forest ERUs that are moderately departed. The locations where this species has been found have had wildfire burn through them, but it is not known at what intensity. This plant is dependent on mature forests as it is a hemiparasitic perennial herb (NatureServe 2016). This species has a small distribution in the Gila NF, as it only occurs within a 400-square-mile area in Catron County (NatureServe 2016). Threats to the species would include anything that would remove mature forests, such as logging and uncharacteristic wildfire. It has been described as rare overall, but locally “common on mature forest floors” (NatureServe 2016). Trend has not been documented in the Gila NF, but it may be decreasing due to uncharacteristic wildfires that have burned through many of the known locations of this plant. This species should be considered at-risk in the Gila because its trend may be declining, and it is identified as globally “imperiled” (G2) in NatureServe.

Metcalfe's penstemon (*Penstemon metcalfei*) occurs in cliffs and steep north slopes of montane conifer forest from 6,600-9,500 feet elevation. This species occurs within the Ponderosa Pine Forest and Mixed Conifer-Frequent Fire ERUs, which are moderately to highly departed from reference conditions (USDA FS Gila NF 2017). Associated species include Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), Gambel oak (*Quercus gambelii*), orange gooseberry (*Ribes pinetorum*), alpine woodsorrel (*Oxalis alpina*), scarlet penstemon (*Penstemon barbatus*), New Mexico locust (*Robinia neomexicana*), red elderberry (*Sambuccus racemosa*), chokecherry (*Prunus virginiana*), canyon maple (*Acer grandidentatum*), and aspen (*Populus tremuloides*) (Roth 2016). It is presently known from a small region of the Black Range in Trujillo and Percha canyons. The majority of the occupied habitat and all five known sites of Metcalfe’s penstemon burned moderately to severely in the 2013 Silver Fire (Roth 2016). In addition to fire severity impacts and canopy removal, much of the stream bank habitat of Metcalfe’s penstemon was significantly impacted by post-fire erosion, including stream bank scouring and incision, debris flows and large volumes of debris deposition (Roth 2016). Because very few plants were documented in 2014, and Metcalfe’s penstemon appears to have a preference for growing in cool, shady areas, underneath the canopy of mixed conifer forests and along stream banks, the species may not persist over time in the majority of documented sites in the Gila NF, due to radical habitat alterations caused by the Silver Fire (Roth 2016). A total of 138 plants were found during the post-fire surveys conducted by Roth (2016), and no plants were found at the type locality where there were once “thousands” documented. Trend for this species appears to be declining in the Gila NF. This species should be considered at-risk in the Gila NF because the majority of its habitat and all known locations have burned in the last 5 years, the ERUs it occurs within are moderately to highly departed from reference conditions, and it is identified as globally “critically imperiled” (G1) in NatureServe.

Davidson's cliff carrot (*Pteryxia davidsonii*) occurs on moist, rocky places on sheer north-facing cliffs in woodland ERUs between 6,500 to 8,000 feet elevation (NMRPTC 1999). The woodland ERUs are in low to moderate departure from reference conditions across the Gila NF (USDA FS Gila NF 2017). The species is found in the Burro Mountains, near Silver City, and near the town of Mogollon. Threats are not well known, but may include mining or mineral exploration. This plant inhabits cliff faces that are inaccessible, which effectively removes most threats to this species. Geologic features that comprise cliff habitat likely are in low departure from reference conditions. Another threat to the species may include uncharacteristic wildfire. The 2012 Whitewater-Baldy fire may have burned one of the known sites, but no surveys have been conducted to evaluate effects. There is no documentation on abundance or trend for this species in the Gila NF, but it may be more abundant than we think because it inhabits rugged, inaccessible habitat that is difficult to survey. Also, trend for the species in the Gila NF may be stable based on that same inaccessibility. Range-wide, short-term trend is relatively stable less than 10 percent change, while the long-term trend is estimated to be stable with no evidence to the contrary (decline of less than 30 percent to increase of 25 percent) (NatureServe 2016). This species should be considered at-risk in the Gila NF because it is identified as globally “imperiled” (G2) in NatureServe.

Mimbres figwort (*Scrophularia macrantha*) occurs on north-facing slopes in piñon-juniper woodlands to dry mixed conifer between 6,500 to 8,200 feet elevation (NMRPTC 1999). Woodland ERUs are in low to moderate departure from reference conditions, but ponderosa pine and mixed conifer forest with frequent fire are moderately to highly departed from reference conditions (USDA FS Gila NF 2017). Fire may have affected frequent fire ERUs (Ponderosa Pine and Mixed Conifer-Frequent Fire forests) more severely than the woodland ERUs. This species is located along the HWY 152 corridor in Gallinas, Railroad, and Bear Canyons on the east side of the Black Range crest. Many of these populations may have been misidentified as the similar looking mountain figwort (*Scrophularia montana*), which occurred within the habitat of Mimbres figwort (Roth 2016). This may explain why several of the historic populations may not have been found, particularly the locations outside the 2013 Silver Fire boundary. Mimbres figwort may be far more rare than previously thought (Roth 2016). Currently, 15 of 16 existing sites occur within the 2013 Silver Fire boundary. Most of these previously documented sites did not burn, but may have experienced some post-fire flooding and associated scouring of the stream banks. Nonetheless, plants should still be expected along the slopes adjacent to the stream banks, from where they were previously reported. Because Mimbres figwort appears to prefer growing in cool, shady areas, underneath the canopy of mixed conifer forests and along stream banks, the species may not persist over time in the majority of documented sites in the Gila NF due to radical habitat alterations caused by the Silver Fire (Roth 2016). Additional threats may include mining or mineral exploration, road construction or maintenance, and collection, particularly adjacent to campgrounds where this plant was historically found. No documentation on abundance was available before the fire in the Gila NF, but post-fire surveys conducted by Roth (2016) documented fewer than 400 individuals within the fire perimeter and only 10 outside. They were located in groups of 25 individuals or less. Trend has not been documented for this species in the Gila NF, but the plant was not found at historic sites, most of which were outside the fire boundary. The trend may therefore be declining, but it may be due to factors other than the fire effects. Also, misidentification of the plant within several of the historic sites may explain why the plant was absent from some of the sites and the trend may be more stable.

This species should be considered at-risk in the Gila because its trend may be declining, all but one known site was burned in the 2013 Silver Fire, and it is identified as globally "imperiled" (G2) in NatureServe.

Wright's catchfly (campion) (*Silene wrightii*) occurs on cliffs and rocky outcrops in conifer forests between 6,800 to 8,000 feet elevation (NMRPTC 1999). The cliff habitat in which the species occurs is not likely departed from reference conditions. The species is fairly well distributed in the Gila NF from near the town of Mogollon, east to just north of the town of Kingston on the Black Range. Current land uses apparently pose no threats to this species as the cliff/crevice habitat it occupies is relatively inaccessible and offers considerable protection (NMRPTC 1999). Abundance and trend for this species in the Gila NF are not known. This species is fairly well distributed across Gila NF, current land uses apparently pose no threat to the species because habitat is relatively inaccessible, and cliff habitat is not likely departed from reference conditions. However, this species should be considered at-risk in the Gila NF because it is identified as globally "imperiled" (G2) in NatureServe.

Porsild's starwort (*Stellaria porsildii*) occurs in shade and partially open understory of mixed conifer with aspen between 7,900 to 8,200 feet elevation (NMRPTC 1999). Mapped locations in the Gila NF show that this plant may occur within Ponderosa Pine Forest, Mixed Conifer-Frequent Fire, and Mixed Conifer with Aspen ERUs. The Ponderosa Pine Forest ERU is highly departed from reference conditions, while the Mixed Conifer-Frequent Fire and Mixed Conifer with Aspen ERUs are moderately departed from reference conditions (USDA FS Gila NF 2017). These ERUs are not modelled to improve in the future. This species is occasionally found scattered on roadsides with steep, loamy and rocky embankments. It has been found along roadsides on the road to Signal Peak in the Pinos Altos Range and in the immediate vicinity of Signal Peak in the Gila NF. Road maintenance activities may affect populations that occur along roadsides or road cuts. Drought is reported as a threat as plants may not emerge during dry periods. Additionally, forest fire, grazing, and recreational impacts may be threats but have not been studied (NatureServe 2016). All known populations in the Gila NF have been burned in the 2014 Signal Fire. There is no documentation for abundance in the Gila NF, but this species has only been found in two disjunct populations (one in Arizona and one in New Mexico) and are known to occupy only a small area in each. This species is not likely very abundant. Trend has also not been documented for this species as it has not been studied, but may be declining since this is a shade-loving species and much of the forest overstory where this plant occurred was removed by the 2014 Signal Fire. This species should be considered at-risk in the Gila because its trend may be declining, all known sites were burned in the 2014 Signal Fire, and it is identified as globally "critically imperiled" (G1) in NatureServe.

Pinos Altos flame flower (*Talinum humile*) occurs in pine/oak woodland on rocky, south facing slopes, usually on shallow, gravelly, usually clayey soils overlaying rhyolite (NMRPTC 1999). Mapped locations in the Gila NF place this species in Piñon-Juniper Woodland, Madrean Piñon-Oak Woodland, and Ponderosa Pine-Evergreen Oak forest ERUs. The woodland ERUs are currently in low to moderate departure from reference conditions, while the Ponderosa Pine-Evergreen Oak ERU is moderately departed (USDA FS Gila NF 2017). Modelling suggests these ERUs will remain in the same conditions or get worse in the future. This species is distributed in the Pinos Altos Range and around the Mimbres Valley. It is located along HWY 15 in the Pinos Altos Range north of Silver City, east to Noonday and Gallinas Canyons, and in Rabb Park. Threats include grazing and, to a lesser extent, housing developments. Threats from grazing in at least two sites in New Mexico have been alleviated causing those populations to "explode" until other vegetation became competitive. This plant seems to grow in inaccessible areas where grazing is the only threat (NMRPTC 1999).

Abundance is not well known in the Gila NF, but it is likely not very abundant as range-wide numbers are a little more than 2,000 individuals. Trend is not well documented in the Gila NF, but the locations where the numbers “exploded” are at sites immediately adjacent to the forest boundary. Grazing occurs on National Forest System lands, so trend may be stable to declining. Overall trend for the species range-wide shows a short-term trend of a 30 to 70 percent decline (NatureServe 2016). This species should be considered at-risk in the Gila because its trend may be declining, and it is identified as globally “imperiled” (G2) in NatureServe.

Mogollon clover (*Trifolium neurophyllum*) occurs in wet meadows, springs, and along riparian corridors in montane coniferous forest from 6,500 to 9,000 feet elevation (NMRPTC 1999). It can occur within Ponderosa Pine Forest, Mixed Conifer-Frequent Fire forest, Upper Montane Conifer-Willow, Ponderosa Pine-Willow, Arizona Alder-Willow, and Herbaceous Wetland Riparian ERUs in the Gila NF (USDA FS Gila NF 2017). The two forested ERUs are moderately to highly departed from reference conditions, while the riparian ERUs are in low to moderate departure across the Gila NF. There is no departure data for herbaceous wetlands, so the departure of that ERU is not known. The forested ERUs have been modelled and show no improvement into the future, but the riparian ERUs have not been modelled because there was insufficient data for model runs (USDA FS Gila NF 2017). In Arizona, the plant has been found in drier areas (Ponderosa Pine Forest, Mixed Conifer-Frequent Fire ERUs), but not in New Mexico. The species has a fairly broad distribution in the Gila NF and is found from just east of the town of Mogollon, north and east to the Tularosa Mountains, north to the Mangas Mountains, and west to the Arizona state line. Threats include drought and impacts to riparian habitat due to grazing, both native and domestic, or drying of streams or wet meadows through water developments (NatureServe 2016, NMRPTC 1999). Abundance is not well documented in the Gila NF, but estimates of known sites show there are approximately between 10,000-16,000 individuals distributed across the Gila NF with several populations containing several thousand individuals. Trend has not been documented in the Gila NF, but it may be decreasing due to continued habitat disturbance from grazing pressures and continued drought conditions (NatureServe 2016). This species should be considered at-risk in the Gila because its trend may be declining, and it is identified as globally “imperiled” (G2) in NatureServe.

Mogollon death camas (*Zigadenus mogollonensis*) occurs in wet mixed conifer, sub-alpine fir over 8,700 feet elevation (NMRPTC 1999). The Mixed Conifer with Aspen and Spruce-Fir Forest ERUs are moderately to highly departed from reference conditions in the Gila NF, and the Spruce-Fir Forest ERU is modelled to worsen into the future (USDA FS Gila NF 2017). While the Spruce-Fir Forest ERU historically burned on a 150- to 400-year cycle with mixed-severity to stand-replacement fire, the mean patch size of the disturbances was historically 200 to 1,000 acres (USDA FS Gila NF 2017). This species is adapted to growing under the canopy of mixed conifer forests (Roth 2016); therefore, it is likely that it persisted historically even though the ERUs it occurs in burn typically with severe conditions. The extent of fires that burned historically were not likely as broad as the most recent fires, which could impact persistence with fewer sites that are considered suitable. All known populations burned during the Whitewater-Baldy Fire in 2012. Thirty-four sites where this plant occurred within the 2012 Whitewater-Baldy fire perimeter were documented, and only 6 of the sites had not burned. In 28 of the sites, fire burned severely and up to several thousand plants were found at these sites. In the 6 unburned sites there were 71 plants found. The species was found to be growing post-fire in numerous locations, but because Mogollon death camas has never been observed to grow naturally in open areas, the species may not persist over time in the majority of documented sites in the Gila NF due to radical habitat alterations caused by the Whitewater-Baldy Fire (Roth 2016).The species is distributed in the Mogollon Mountains, centered around Willow Mountain, in an area of approximately 5 miles x 6.5 miles (Roth 2016). This plant is not threatened by current forest uses, and livestock will not intentionally eat them as they are thought to be poisonous (NMRPTC 1999). Trend has not been documented in the Gila NF, but may decline due to alterations to its habitat after the 2012 Whitewater-Baldy fire. This species should be considered at-risk in the Gila because its trend may be declining, and the ERUs in which the species occurs are moderately to highly departed and modelled to get worse in the future.

Mammals

Gunnison's prairie dog (prairie population) (*Cynomys gunnisoni*) occurs in grasslands/shrublands 6,000 to 12,000 feet. The species is relatively well distributed in the north half of the Gila NF as it is found from Kemp Mesa, near Beaverhead, north and west to the northern boundary of the Gila NF. Information is lacking on population size or trends, but it is thought some of the populations in the Gila NF are declining (Monzingo 2016). Habitat restoration work currently being conducted in areas that are occupied may benefit the species by moving grasslands more toward reference conditions. Short-term trend appears to be relatively stable to less than 30 percent, but the long-term trend shows a 70 to 90 percent decline (NatureServe 2016). This species should be considered at-risk in the Gila NF because the ERUs they inhabit are moderately to highly departed and not modelled to improve in the future, numbers in the forest may be declining, and high susceptibility to Sylvatic plague.

Arizona montane vole (*Microtus montanus arizonensis*) occurs in mesic meadows in ponderosa pine and mixed conifer. The Ponderosa Pine Forest, Mixed Conifer-Frequent Fire, and Mixed Conifer with Aspen ERUs are highly, moderately to highly, and moderately departed, respectively (USDA FS Gila NF 2017). The species is found in two disjunct and isolated locations in the Gila NF. One location is in the northwest part of the forest in Centerfire Bog, while the other is located to the west near the Arizona state line in Jenkins Creek (Frey et al. 1995). These two locations are separated by approximately 8 miles. Threats include habitat alteration through over-grazing or other activities that dry out mesic meadows (BISON-M 2016). Abundance of the species may be quite low as trap attempts yielded only one vole, even though 40 Sherman traps were set and there was an abundant number of vole runways with fresh feces and grass clippings (Frey et al. 1995). In New Mexico, the trend is unknown as the previously mentioned sites are the only locations the vole has been found. However, in Arizona surveys have found that it is much more abundant than once thought (BISON-M 2016). This species should be considered at-risk in the Gila NF because the ERUs they inhabit are moderately to highly departed and not modelled to improve in the future, only two isolated populations have been found in the forest, and numbers at both sites appear to be very low.

Lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*) has been recently (April 2018) delisted from the Federal threatened and endangered species list. The lesser long-nosed bat is a nectar, pollen, and fruit-eating bat that migrates seasonally from Mexico to southern Arizona and southwestern New Mexico. This bat pollinates species of columnar cacti and paniculate agaves and disperses seeds of columnar cacti throughout its range (USDI FWS 1995). In 2011, lesser long-nosed bats were captured and photo-documented at two separate sites in the Burro Mountains, on both sides of the Continental Divide. Both sites were on private land, but one piece was a private inholding within NFS lands and the other was adjacent to the forest. However, it is believed that the bats are foraging at nearby Palmer’s agaves (primarily within the Forest), or at least checking them out for nectar (M. Ramsey, pers. comm. 2016). Based on the location of species documentation, they could occur in Semi-Desert Grassland, Piñon-Juniper Grass Woodland, Piñon-Juniper Woodland, and Madrean Piñon-Oak Woodland ERUs. With the exception of Semi-Desert Grasslands, which are highly departed, the other three ERUs are in low to moderate departure and modelled to remain so into the future (USDA FS Gila NF 2017). Threats from grazing on food plants, the tequila industry, and prescribed fire are likely not as severe as once thought. Human disturbance of roost sites, urban development, catastrophic fire, and changing fire regimes resulting from non-native invasive plants are still considered threats. Two new threats that have been identified include illegal border activities and their enforcement actions, as well as new wind farms (USDI FWS 2007b). This species should be considered at-risk in the Gila NF because they have only been recently documented at two sites within the forest boundary, roost sites have not been documented, and a couple of ERUs are moderately to highly departed and not modelled to improve in the future.

Each SCC is associated with one or more vegetation communities. Vegetation communities are where the species is known to spend all, or most of its life, or it can be a special ecological feature within a vegetation community that provides habitat for a critical life cycle need. Identifying degraded ecological conditions allows forest staff to best direct their management actions to maintain or improve conditions for SCC. Table 27 shows vegetation communities and associated SCC.

Table 27. Vegetation systems, vegetation community within the vegetation systems, and associated SCC

Vegetation System	Vegetation Community Name and Code	Associated SCC
High-Elevation Forest	Spruce-Fir Forest (SFF) Mixed Conifer with Aspen (MCW)	Marsh slug snail, nitocris fritillary butterfly, western bumblebee, Gooding's onion, heartleaf groundsel, Hess's fleabane, Mogollon death camas, Mogollon hawkweed, Mogollon Mountain lousewort, Porsild's starwort, yellow lady's-slipper, Arizona montane vole
Frequent Fire Forest	Mixed Conifer-Frequent Fire (MCD) Ponderosa Pine (PPF) Ponderosa Pine-Evergreen Oak (PPE)	Arizona toad, Lewis's woodpecker, Iron Creek woodlandsnail, marsh slug snail, Silver Creek woodlandsnail, western bumblebee, Arizona crested-coralroot, Gila morning glory, Gooding's onion, Mimbres figwort, Mogollon clover, Mogollon hawkweed, Pinos Altos flame flower, Porsild's starwort, yellow lady's-slipper, Arizona montane vole
Woodlands	Piñon-Juniper Woodland (PJO) Piñon-Juniper Grass Woodland (PJG) Juniper Grass Woodland (JUG) Madrean Piñon-Oak Woodland (MPO) Piñon-Juniper Evergreen Shrub Woodland (PJC)	Arizona toad, *Oreohelix metcalfei acutidiscus* (mountainsnail), *O. m. hermosensis* (mountainsnail), *Ashmunella cockerelli* (woodlandsnail), Cockerell holospira snail, Iron Creek woodlandsnail, Mineral Creek mountainsnail, *A. c. perobtusa* (snail), *O. m. radiata* (snail), *O. m. concentrica* (snail), western bumblebee, Arizona crested-coralroot, Gila morning glory, Greene's milkweed, Mimbres figwort, Ray Turner's spurge, Wright's dogweed, Gunnison's prairie dog, lesser long-nosed bat
Grasslands	Montane/Subalpine Grasslands (MSG) Colorado Plateau/Great Basin Grasslands (CPGB) Semi-Desert Grassland (SDG)	Western bumblebee, Greene's milkweed, Ray Turner's spurge, Gunnison's prairie dog, lesser long-nosed bat
Riparian/Aquatic	Cottonwood/Willow Group (CWG) Desert Willow Group (DWG) Montane-Conifer/Willow Group (MCWG) Walnut-Evergreen Tree Group (WEG) Wetland (Cienega) Group (WET)	Arizona toad, Gila woodpecker, Lewis's woodpecker, Rio Grande sucker, Roundtail (Headwater) chub, "Gila" may fly (*Lachania dencyanna*), *Capnia caryi* (stonefly), bearded mountainsnail, Gila springsnail, Morgan Creek mountainsnail, New Mexico hot springsnail, *Ashmunella cockerelli angenticola* (snail), *A. tetrodon animorum* (snail), *A. t. inermis* (snail), *A. t. mutator* (snail), Sonoran snaggletooth snail, *Taenionema jacobii* (stonefly), western bumblebee, Whitewater Creek woodlandsnail, Chiricahua Mountain mudwort, Gooding's onion, Metcalfe's penstemon, Mogollon clover, Wooton's hawthorn, lesser long-nosed bat
Cave-like structures, Rocky features, soils	Cliffs, rocky outcrops, steep, talus slopes, soil specific, mine adits, cave-like structures	*Oreohelix metcalfei acutidiscus* (mountainsnail), *O. m. hermosensis* (mountainsnail), *Ashmunella cockerelli* (woodlandsnail), Cockerell holospira snail, Mineral Creek mountainsnail, *A. c. perobtusa* (snail), *O. m. radiata* (snail), *O. m. concentrica* (snail), Silver Creek woodlandsnail, Cliff brittlebush, Davidson's cliff carrot, Gila morning glory, Hess's fleabane, Metcalfe's penstemon, Mimbres figwort, Pinos Altos flame flower, Wright's catchfly (campion), Wright's dogweed, Arizona montane vole
Flowering Plants	All ERUs	Western bumblebee

Environmental Consequences for Species of Conservation Concern

Environmental Consequences Common to All Alternatives

Effects of probable management activities that could potentially affect wildlife communities can be grouped into three broad categories: (1) changes in the type, quantity, quality, and spatial arrangement of suitable ecological conditions; (2) direct mortality, reduced survival, or increased susceptibility to mortality; and, (3) increased disturbance.

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 were added as needed. Appendix D lists the forest-wide plan components that would apply to Species of Conservation Concern (SCC) wildlife and plant species under all action alternatives.

Ecological Condition

All five alternatives would use mechanical vegetation treatment and wildfire to varying degrees to manage all upland ERUs, and mechanical vegetation treatment or structural improvement to manage riparian/water resources (e.g., aquatics, riparian ERUs) to improve ecological condition, abundance, and distribution for species that depend on those vegetation communities. Depending on the alternative, the acreage difference varies as well as the ERUs in which the activities would take place. These systems have varying departure ratings (low to high) from reference conditions. Any of these activities has the potential to modify habitat and create a disturbance for SCCs, but all activities in the alternatives are intended to move ecological conditions closer to desired conditions. This would improve the ecological conditions for SCCs increasing resilience of ERUs to uncharacteristic disturbances and improving the likelihood of long-term persistence. Current science demonstrates the positive benefits that forest fuel-reduction treatments can have in terms of improving resiliency in frequent fire-adapted systems of the West/Southwest (Stephens et al. 2012).

For species that use any of the Upland ERUs, Riparian (wetlands and Forested Riparian), and aquatic systems (see table 27), the primary contemporary threats are loss of habitat related to large stand-replacing wildfire and its associated increased run off and sedimentation that could affect riparian/aquatic habitat, and potentially reduce in-stream flow. All alternatives would move ecological condition for these species toward desired conditions, but would vary in magnitude, intensity and location of treatments (see table 28). There could be some localized impacts to these species, but overall, species would continue to persist. Beneficial impacts includes improvement in potentially suitable ecological condition in Upland Vegetation ERUs, Riparian, and Aquatic systems by increasing the amount of habitat in the desired seral states or properly functioning condition for breeding, roosting, and foraging. Objectives to treat acres in these departed systems would move those systems toward a vegetative or aquatic state to which these species have adapted. For species using Cliff, Caves, Mines, and Rocky Features, the primary threats are ground disturbing activities such as mining, road construction or maintenance, and recreational activities (e.g., rock climbing) as well as climate change. Ecological conditions of cliffs, caves, and talus slopes has not and likely will not change substantially over time and geologic forces act on them over long time periods. Species in these areas will also likely be impacted by activities that may occur within the ERUs where the features are located. Therefore, moving the ERUs toward desired conditions along with plan components developed specifically for these features will likely provide benefits to the species that occupy these sites and provide conditions for their persistence.

Table 28. Comparison of vegetation management between alternatives

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Priority Vegetation Types for restoration	No Objectives for specific vegetation types forest-wide	Combination of grassland and open-canopy woodlands, and forest types	Grassland and open-canopy woodlands	Forest types	Combination of grassland and open-canopy woodlands, and forest types
Spruce-Fir Forest	No Objective	Objective[y] Treat 250 - 23,779 acres per decade using a combination of naturally ignited wildfire and prescribed fire	No Objective	No Objective	No Objective
Mixed Conifer with Aspen	No Objective, but from 2007 to 2017 treated 167 acres using mechanical methods; 77 acres with prescribed fire and 1,539 acres using naturally ignited wildfire	Objective Treat 300 - 73,934 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	No Objective	Objective Treat at least 300 acres per decade ***using mechanical methods and no more than 20 acres per decade using prescribed fire***	No Objective
Mixed Conifer-Frequent Fire	No Objective, but from 2007 to 2017 treated 515 acres using mechanical methods; 4,795 acres with prescribed fire and 29,515 acres using naturally ignited wildfire	Objective Treat 6,875 - 282,400 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	No Objective	Objective ***Treat at least 12,500 acres per decade using mechanical methods and no more than 2,000 acres per decade using prescribed fire***	Objective ***Treat 5,500*** - 282,400 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Ponderosa Pine Forest	No Objective, but from 2007 to 2017 treated 9,445 acres using mechanical methods; 50,508 acres with prescribed fire and 59,274 acres using naturally ignited wildfire	Objective Treat 6,320 - 600,300 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	No Objective	Objective ***Treat at least 29,230 acres per decade using mechanical methods and no more than 12,600 acres per decade using prescribed fire***	Objective ***Treat 55,000*** - 600,300 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***

[y] The pool of congressionally appropriated dollars for vegetation treatments between 2007 and 2017 to develop plan objectives under each alternative. These funds were re-allocated between treatments types based on treatment cost estimates and the theme of the alternative. The exercise was intended to demonstrate that the plan is within the fiscal capacity of the forest, which is a requirement of the 2012 Planning Rule. If partnerships and associated funding make additional treatment possible, acreage will change.

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Ponderosa Pine-Evergreen Oak	No Objective, but from 2007 to 2017 treated 4,093 acres using mechanical methods; 33,411 acres with prescribed fire; and treated 29,360 acres using naturally ignited wildfire	<u>Objective</u> Treat 1,000 - 540,000 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	No Objective	<u>Objective</u> ***Treat at least 10,000 acres per decade using mechanical methods and no more than 2,000 acres per decade using prescribed fire***	<u>Objective</u> ***Treat 25,000*** - 540,000 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
PJ Grass Woodland	No Objective, but from 2007 to 2017 treated 2,890 acres using mechanical methods; 3,795 acres with prescribed fire and; 10,623 acres per decade using naturally ignited wildfire	<u>Objective</u> Treat 4,000 -145,800 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	<u>Objective</u> ***Treat at least 19,000 acres per decade using mechanical methods and no more than 500 acres per decade using prescribed fire***	No Objective	<u>Objective</u> ***Treat 24,000*** - 145,800 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Juniper Grass Woodland	No Objective, but from 2007 to 2017 treated 190 acres using mechanical methods; 30 acres with prescribed fire and; 0 acres using naturally ignited wildfire	<u>Objective</u> Treat 4,000 - 88,000 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	<u>Objective</u> ***Treat at least 13,000 acres per decade using mechanical methods and no more than 500 acres per decade using prescribed fire***	No Objective	<u>Objective</u> ***Treat 18,000*** - 88,000 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
PJ Woodland	No Objective, but from 2007 to 2017 treated 6,717 acres using mechanical methods; 34,182 acres with prescribed fire; and 34,321 acres using naturally ignited wildfire	No Objective	No Objective	No Objective	No Objective

Resource or Activity	Alternative 1 Current (1986) Plan	Alternative 2 Proposed Plan	Alternative 3	Alternative 4	Alternative 5
Montane/Subalpine Grasslands	No Objective, but from 2007 to 2017 treated 5,359 acres using mechanical methods; 5,220 acres with prescribed fire; and 11,334 acres using naturally ignited wildfire	<u>Objective</u> Treat 4,600 - 94,800 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	<u>Objective</u> ***Treat at least 11,000 acres per decade using mechanical methods and no more than 500 acres per decade using prescribed fire.***	No Objective	<u>Objective</u> ***Treat 12,000*** - 94,800 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Colorado Plateau-Great Basin Grassland	No Objective, but from 2007 to 2017 treated 1,375 acres using mechanical methods; 470 acres with prescribed fire; and 1,259 acres per decade using naturally ignited wildfire	<u>Objective</u> Treat 2,000 - 59,500 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	<u>Objective</u> ***Treat at least 8,800 acres per decade using mechanical methods and no more than 500 acres per decade using prescribed fire***	No Objective	<u>Objective</u> ***Treat 10,000*** - 59,500 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Semi-Desert Grassland	No Objective, but from 2007 to 2017 treated 1,270 acres using mechanical methods; 25 acres with prescribed fire; and 883 acres per decade using naturally ignited wildfire	<u>Objective</u> Treat 800 - 88,900 acres per decade using a combination of naturally ignited wildfire, prescribed fire and mechanical methods	<u>Objective</u> ***Treat at least 6,000 acres per decade using mechanical methods and no more than 250 acres per decade using prescribed fire***	No Objective	<u>Objective</u> ***Treat 8,000*** -88,900 acres per decade using a combination of ***naturally ignited wildfire and prescribed fire***
Riparian Management (roads & infrastructure)	No plan direction	New construction or realignment of roads and motorized routes, recreation sites or other infrastructure should not be located within the 100-year floodplain, or within 300 feet of a Riparian Management Zone	Same as alternative 2	Same as alternative 2	New construction or realignment of roads and motorized routes, recreation sites or other infrastructure should not be located within the 100-year floodplain, or within ***500 feet of Riparian Management Zones containing perennial streams or native trout populations***

Environmental Consequences for Species of Conservation Concern – Alternative 1

The existing 1986 forest plan was developed under the 1982 planning rule and does not include the species of conservation concern concept, however, species of conservation concern are included as part of the current analysis and would replace regionally sensitive species if alternative 1 was selected. In accordance with the 1982 planning rule, each proposed species is evaluated in terms of its ability to persist in the planning unit.

The 1986 forest plan, as amended lacks a description of desired conditions for many of the key ecological characteristics for SCC, as it was not explicitly developed using the coarse-filter, fine-filter approach (a key tenet of the species diversity requirements under the 2012 rule). This would make it hard to ensure projects are implemented in a consistent manner and that projects are moving toward a common set of desired conditions and long-term goals. However, plan direction from the 1996 amendment, BMPs, and site-specific mitigations done at the project level will be used to analyze effects to SCC for alternative 1. While there are no specific plan components that are geared toward species-specific (fine-filter) wildlife, plant, and aquatic ecological condition such as guidance for rare endemic species, protections for cave dwelling mammals like bats, and measures that prevent the spread of certain invasive species including wildlife diseases (e.g., white nose syndrome, chytrid fungus) and predators (e.g., bull frog), there are guidance documents, BMPs, and project-level design features that currently address all of these management issues. Current direction for invasive species is primarily focused on noxious weeds, but the forest continues to work with partners following guidance for the removal of non-native invasive aquatic species on a site-specific basis.

Alternative 1 would continue to maintain current rates of planned and unplanned natural ignition and mechanical vegetation treatment, which would move the majority vegetation states toward desired conditions but at a slower rate than most of the action alternatives. Mixed Conifer Frequent with Aspen would move closer to desired conditions at a faster rate than other action alternatives, improving to a low departure rating of 30 percent from moderately departed 40 percent under this alternative desired condition after 10 to 15 years. This is likely because there is very little treatment in this ERU and the larger, more closed forest conditions would improve toward desired conditions. None of the other ERUs change departure ratings and remain relatively stable with slight changes in departure percentages. This would be a slight overall improvement from current conditions.

Most of the standards and guidelines that have the potential to benefit wildlife in the current 1986 forest plan are also found in the action alternatives in the form of desired conditions, guidelines, or management approaches. In many places, the current 1986 forest plan reiterates existing law, regulation, or policy, but these are incorporated by reference in the action alternatives and are considered more specifically at the project level.

Alternative 1 (no action alternative) is to continue using the 1986 forest plan including all associated amendments, which is the combination of using naturally ignited wildfire, prescribed fire and mechanical treatments or thinning treatments. Prescriptive (restrictive) standards and guidelines in the current forest plan make it difficult to apply adaptive management, as understanding about management effects on ecosystems and wildlife changes. Adaptive management will be essential to effectively manage for climate change or any other changes in management that may be needed through changing and uncertain conditions, or with new and better scientific information. Climate change has the potential to affect all wildlife and plant species, and influences the likelihood of large-scale disturbance (e.g., fire, bark beetle outbreaks) across the landscape. Alternative 1 does not recognize climate change and offers limited guidance associated with management activities (e.g., salvage logging, blow down) related to such disturbance events. Guidance for salvage operations is general in nature and focuses more on the enhancement of timber production rather than an integrated approach that balances management with other resource values such as wildlife habitat. The forest would continue to follow existing law, regulation, policy, and best management practices to address species viability concerns in areas affected by large-scale disturbance.

There is no recommended wilderness and both wilderness study areas are not recommended for wilderness designation under alternative 1.

Environmental Consequences for Species of Conservation Concern Common to Action Alternatives 2 through 5

Action alternatives 2 through 5 are more strategic in nature and integrated than the current 1986 forest plan (alternative 1). All action alternatives were developed using the coarse-filter/fine-filter approach to develop plan components to support SCC from the 2012 Planning Rule. This approach is critical in enabling the adaptive management feedback loop between the plan and the plan monitoring program and helps ensure that the ecological conditions for SCC species are maintained and will provide for their persistence. All action alternatives include plan direction designed to maintain the diversity of plant and animal communities and support the persistence of native species within the plan area, subject to the extent of Forest Service authority and the inherent capability of the plan area.

The main differences between alternatives 2 through 5 that could impact SCCs include the amount of acres recommended to Congress for wilderness designation, the amount and role of mechanical treatments and wildland fire as restoration tools, and the amount of riparian/aquatic systems restored. The action alternatives more proactively incorporate this thinking than alternative 1. The action alternatives also make better use of partnerships and collaboration to maintain ecosystem integrity and resilience.

Adaptive management will be essential to effectively manage for climate change and associated impacts from disturbance events and invasive species in changing and uncertain conditions. The action alternatives include a monitoring plan designed to better inform the effects and effectiveness of management and progress toward desired conditions. Alternatives 2 through 5 better recognize and address the negative effects non-native invasive species and disease can have on ecosystem integrity and biological diversity. Direction for invasive species was updated and expanded to recognize the threats to ecosystem resilience from all non-native invasive aquatic and terrestrial plants and animals likely to cause harm to ecosystems. Finally, climate change may push rare and endemic species to the limits of their range and evolutionary capacity. This is expected to be especially significant in the Southwest, an area already affected by long term drought. The action alternatives recognize and include plan components to help address that threat and to reduce the risk of removing ecological conditions important for SCCs.

Recommended wilderness is proposed under alternatives 2 through 5, and the amount of recommended wilderness varies by alternative as shown in table 29:

Table 29. Acres of recommended wilderness by alternative

Alternative	Acres of Recommended Wilderness
2	110,402
3	130,012
4	72,901
5	745,286

Recommended wilderness could potentially provide beneficial effects to SCCs through its management for the protection or improvement of wilderness character, which minimizes disturbance to species and provides habitat connectivity. However, the Gila NF would also be more limited in its ability to treat these areas through mechanical cutting or prescribed fire and would rely on wildland fire as its main restoration tool. Limiting the ability to treat these areas may leave these areas vulnerable to large, contiguous extents of high-severity fire and cause these areas to become more departed in the future. More departed ecological conditions in the future may negatively affect species dependent on this habitat.

Plan components that support resilient and resistant ecosystems and watersheds, would protect species from the negative effects of climate change and would give wildlife species the best opportunity to adapt to changing conditions. These plan components would be beneficial for all wildlife, plant, and aquatic species but especially those species that depend on riparian systems, aquatic systems, endemic species/species with restricted distributions, and species that move across large landscapes and use habitat at multiple spatial scales. This type of plan language, which is included in the four action alternatives, is not explicitly called out under alternative 1 and should have a more positive effect on all species. A comprehensive list of plan components that would benefit wildlife species has been put together in a crosswalk list (appendix D), and we direct the reader to this appendix to see specific examples, so they will not all be presented in this section.

All action alternatives will maintain riparian management zones in, or trending toward proper functioning condition (or equivalent condition class). No new construction or realignment of roads and motorized routes, recreation sites or other infrastructure should be located within the 100-year floodplain, or within 300 feet of a riparian management zone for alternatives 2, 3, and 4, and 500 feet of a riparian management zone containing perennial streams or native trout populations in alternative 5. Treatments on the landscape in the uplands have the potential to increase sedimentation into riparian and aquatic areas. There is more acreage of treatment in alternatives 2 and 5 than alternative 1, but there are desired conditions, standards, and guidelines (e.g., Timber, Forest, and Botanical Products DC 1, STD 1 and 5, GL 3, 6, and 7)[z] that would minimize these impacts, as well as reduce the potential for undesirable effects from uncharacteristic fire, drought, wind, insect infestations, and disease epidemics.

Set objectives to restore structure and function of at least one riparian project annually, above and beyond any noxious or invasive weed treatments (Riparian and Aquatic Ecosystems OB-1), 20 activities and projects that contribute to the recovery of federally listed species and maintain or enhance upland habitat connectivity over each 10-year period (Wildlife, Fish, and Plants OB-3 and 5), and objectives to restore, enhance, or maintain 100 stream miles (Wildlife, Fish, and Plants OB-4), and reduce non-native fish and other aquatic species within native aquatic populations 4-6 stream

[z] DC=Desired Condition; OB=Objective; STD=Standard; GL=Guideline

reaches, and eradicate non-native fish populations from at least one stream reach containing a natural or constructed barrier in compliance with recovery plans during each 10-year period (Non-native Invasive Species OB-4 and 5, respectively). This also includes Desired Conditions in the Roads resource area (DC5) and guidelines (GL 1, 2, and 4) to close or naturalize roads to reduce impacts to ecological resources (that is, watersheds, wildlife and fish habitat, and soil erosion). These plan components would move riparian ecological condition across the forest closer to a desired state.

Species of Conservation Concern and their key ecological components and threats are broadly defined below. Species have been grouped according to their primary ecological needs and threats to eliminate redundancy in the analysis. Refer to the affected environment for the Vegetation ERUs and current departure and trend for each vegetation community associated with SCC species. The forest-wide plan components described below would apply to SCC species across all action alternatives.

All Forested and Woodland ERUs

(SFF, MCW, MCD, PPF, PPE, PJO, PJG, PJC, JUG): See table 27 above for species associated with these ERUs.

- Key Ecological Conditions: Structurally diverse mature forests (seral state), conifer forest, structural heterogeneity, interlocking canopy.
- Key Threats: Risk of loss of ecological condition and habitat fragmentation of conifer forest from wildfire, insect outbreaks, or drought outside the natural range of variability, collection, and climate change.

Coarse filter

Coarse-filter plan components that would benefit the majority of species that depend on Forested and Woodland Ecosystems include desired conditions to maintain appropriate structure, composition, and function at all scales, while reducing fire risk through vegetation management and fuels reduction projects. Desired conditions that incorporate varying structural stages, including uneven-aged forest with openings, occasional even-aged structure with large snags and abundant understory (e.g., coarse woody debris, logs), and old growth components would guide the implementation of forest management activities that would move ERUs toward a more favorable departure and trend from that which currently exists. The full range of life stage needs for rare and endemic plants, aquatic, and terrestrial wildlife (e.g., fledgling, nesting, dispersal, roosting), as well as conditions that would support an adequate prey base for foraging are provided for at multiple spatial scales. (See all Desired Conditions for all scales for Forested and Woodland ERUs and Wildlife, Fish, and Plants.)

Where Gambel oak and other hardwoods occur as a component in conifer forest, desired conditions (All Upland ERUs – DC 1, 2, 6, and 8, GL 1 and 2, MCW, MCD, and PPF – DC 1, and PPF DC 3) would promote their retention during project design to promote canopy cover and moister site conditions for small mammals, plants and insects.

Desired Conditions mentioned above, plus additional coarse-filter plan components under the Wildland Fire and Fuels Management resource area promote endemic levels of disturbance, natural fire regimes, and restoration activities that would allow all forested ERUs to be resilient in the face of climate change, drought, and other disturbance. These include (DC 2 and 5, and GL 1).

Current silvicultural treatments may contribute to short-term impacts to habitat due to disturbances, but they typically do not contribute to habitat loss. The Timber, Forest, and Botanical Products resource area would ensure that silvicultural treatments are used as a restoration tool and desired conditions for this resource (DC 1a-c) would ensure these types of activities are done in a way that enhances wildlife and aquatic ecological conditions. There are also vegetation management Standards (1, 3, 5-10) and Guidelines (2, 3, and 5-7) that would mitigate habitat disturbance and damage that might occur as a result of timber harvest and protect against collection (GL 1, and Wildlife, Fish, and Plant DC 5), so that watershed conditions are protected and the ecological needs of wildlife and plant species are maintained.

Table 30 identifies plan components that address threats listed above. These are just a few plan components that address threats, please refer to appendix D for complete crosswalk.

Table 30. Plan components for Upland ERUs that address threats

Plan Component	Vegetation Name and Code	Threat	SCC
All Upland ERUs DCs, standards, and guidelines.	Spruce-Fir Forest (SFF) Mixed Conifer with Aspen (MCW) Mixed Conifer-Frequent Fire (MCD) Ponderosa Pine (PPF) Ponderosa Pine-Evergreen Oak (PPE) Piñon-Juniper Woodland (PJO) Piñon-Juniper Grass Woodland (PJG) Juniper Grass Woodland (JUG) Piñon-Juniper Evergreen Shrub Woodland (PJC)	Loss of ecological condition and habitat fragmentation of conifer forest from wildfire, insect outbreaks, or drought outside the natural range of variability, and Climate Change	Marsh slug snail, nitocris fritillary butterfly, western bumblebee, Gooding's onion, heartleaf groundsel, Hess's fleabane, Mogollon death camas, Mogollon hawkweed, Mogollon Mountain lousewort, Porsild's starwort, yellow lady's-slipper, Arizona montane vole, Arizona toad, Lewis's woodpecker, Iron Creek woodlandsnail, Silver Creek woodlandsnail, Arizona crested-coralroot, Gila morning glory, Mimbres figwort, Mogollon clover, Pinos Altos flame flower, *Oreohelix metcalfei acutidiscus* (mountainsnail), *O. m. hermosensis* (mountainsnail), *Ashmunella cockerelli* (woodlandsnail), Cockerell holospira snail, Iron Creek woodlandsnail, Mineral Creek mountainsnail, *A. c. perobtusa* (snail), *O. m. radiata* (snail), *O. m. concentrica* (snail), Gila morning glory, Greene's milkweed, Ray Turner's spurge, Wright's dogweed, Gunnison's prairie dog, lesser long-nosed bat

Fine filter

In addition to the ecosystem-based components highlighted above, a number of fine-filter, species-specific plan components were added to address the needs of the SCCs.

Additional fine-filter plan components in Wildlife, Fish, and Plants (see Desired Conditions, Standards, and Guidelines) were developed to meet the breeding, foraging, and roosting needs of Northern goshawk as well as several other wildlife and plant species. Several of the guidelines were developed to mitigate hazards to wildlife species that contribute to connectivity (STD 1, GL 4, 5, 7, and 9), prevention of disease transmission (GL 10), and other human caused hazards associated with management activities (STD 1, GL 4, 5, 7, and 8).

Table 31 identifies plan components that address threats listed above. These are just a few plan components that address threats, please refer to appendix D for complete crosswalk.

Table 31. Plan components for rare and endemic plant and animal species and habitats that address threats

Plan Component	Vegetation Name and Code	Threat	SCC
Rare and Endemic Plant and Animal Species and Habitats, Guideline 2	Spruce-Fir Forest (SFF)	Collection	nitocris fritillary butterfly

Determination: There are numerous plan components developed that address key ecological conditions and key threats for species that rely on Forested and Woodland ERUs for critical life functions (see appendix D) that will apply to all action alternatives, including some species specific components. Applying these plan components will move these ERUs toward desired conditions, at different rates, and ensure persistence of conditions and mitigation of threats needed for persistence of SCCs. This combination of ecosystem and species-specific plan components should provide the ecological conditions necessary to maintain persistence in the plan area.

Riparian and Aquatic Associates

(Riparian ERUs: Cottonwood/Willow Group, Desert Willow Group, Montane-Conifer/Willow Group, Walnut-Evergreen Tree Group, Wetland (cienega) Group): See table 27 for species associated with these ERUs.

- Key Ecological Conditions: Variety of structure and cover, emergent or submergent vegetation, abundant riparian vegetation, overhanging banks and vegetation, rocky streams, permanent water, relatively natural flow regimes
- Key Threats: Loss of riparian ecological condition due to changes in runoff or water levels (uncharacteristic fire effects), diversion (none planned by the Gila NF), invasive species, sedimentation and soil compaction from roads and/or activities such as unauthorized use (no components developed for illegal activities), disease, and competition/predation/hybridization by non-native aquatic species

Riparian habitat includes wetlands and forested riparian (i.e., willow, cottonwood, and sycamore) areas surrounding seeps/springs, perennial streams, lakes, and other water features. According to the Gila NF Final Assessment (USDA FS Gila NF 2017), riparian habitat occupies a very small portion of the forest and riparian conditions range from low to moderate departure, so maintaining the low departure riparian systems while improving the moderately departed riparian systems would likely improve ecological conditions for these species. These species would benefit from plan components that maintain or improve riparian and aquatic conditions toward reference conditions. All action alternatives will maintain riparian management zones in, or trending toward proper functioning condition (or equivalent condition class). No new construction or realignment of roads and motorized routes, recreation sites or other infrastructure should be located within the 100-year floodplain, or within 300 feet of a Riparian Management Zone for alternatives 2 through 4, and 500 feet of a riparian management zone containing perennial streams or native trout populations in alternative 5.

Aquatic habitats these species use would benefit primarily from some of the same plan components that go toward improving riparian habitat. Additionally, plan components that improve upland conditions would benefit riparian and aquatic habitats by reducing the amount of sedimentation after disturbances and maintaining or improving hydrologic flows.

Plan components that would benefit the species that depend on these vegetation communities can be found under the Watershed, Water Quality, Riparian and Aquatic Ecosystems, All Upland ERUs, Non-native Invasive Species, and Wildlife, Fish, and Plants plan sections of the action alternatives. Additional plan components, which balance multiple use with wildlife needs, can be found under the Wildland Fire and Fuels Management, Water Uses, Livestock Grazing, Timber, Forest, and Botanical Products, Roads, Minerals, and Dispersed Recreation sections.

Coarse filter

Plan components within all of the above-mentioned resource sections would help to move these systems toward proper functioning condition (e.g., Riparian and Aquatic Ecosystems Watershed Scale DC3, Fine Scale DC1), while balancing multiple uses with ecological integrity (Livestock Grazing GL1) to avoid excessive grazing impacts. This would provide the key ecological conditions needed for many of the species life functions including abundant overhanging riparian vegetation. These components would help to minimize water diversions and improve hydrologic function, while maintaining systems that are resilient to climate change and associated disturbances, such as fire (Livestock Grazing GL4). There are also standards and guidelines within several sections (e.g., Watershed STD1, Livestock Grazing STD1) that would ensure that BMPs are applied to every site-specific project that has the potential to affect watershed conditions such as erosion and flooding effects due to wildfires. Several standards and guidelines would minimize impacts from road construction or reconstruction (Roads DC4, GL1-4), which can cause sedimentation, and would rehabilitate in-stream structures (Wildlife, Fish, and Plants DC9), which could improve hydrologic function.

Desired conditions and standards within the Timber, Forest, and Botanical Products (DC1, STDs 1, 3, 5) would protect the ecological integrity of watershed conditions by minimizing impacts that could cause soil erosion and sedimentation during timber harvest operations. Plan components for Livestock Grazing (DC 3 and 4, STDs 1 and 3, GL 1, 2, 4, and 5), Riparian and Aquatic Ecosystems (Watershed Scale DC1 and 3, Fine Scale DC1 and 2, STDs 1 and 2), Water Uses (DC1), and Roads (DC 4 and 5, GL 1, 3, and 4) would ensure associated management activities are compatible with ecological function and supportive of diverse native plant communities, including in wetland and riparian management zones. Many of these same plan components also would protect riparian areas from streambed and flood plain alteration, and would minimize disturbance (e.g., water flow, sedimentation) from the construction of roads and energy corridors by including mitigations to limit disturbance during project-level design.

Livestock Grazing guidelines 1 and 3 prevent the construction of new structures in riparian management zones and minimize impacts that the construction of such structures may have on soils and hydrologic function of streams.

Non-native plant species (e.g., tamarisk) can out compete native species, causing a reduction in suitable habitat for these species and alterations in riparian function, while non-native invasive animals and disease pathogens (e.g., Chytrid) can cause direct mortality and predation. These threats are reduced through plan components in the Non-native Invasive Species (DC1 and 2, STDs 1-3, 7, and 9, GL 1, 4-7), Wildlife, Fish, and Plants (GL 6 and 8), and Wildland Fire Management (DC 6, STDs 4-6, GL 2) that minimize impacts to wildlife in riparian areas, and would also prevent pathogen transmission.

Plan components have been developed to implement 20 activities and projects that contribute to the recovery of federally listed species and maintain or enhance upland habitat connectivity over each 10-year period (Wildlife, Fish, and Plants OB-3 and 5), and objectives to restore, enhance, or maintain 100 stream miles (Wildlife, Fish, and Plants OB-4). These objectives would also improve habitat condition and connectivity for SCCs as well.

Table 32 identifies plan components that address threats listed above. These are just a few plan components that address threats, please refer to appendix D for complete crosswalk.

Table 32. Plan components for riparian and aquatic ecosystems that address threats

Plan Component	Vegetation Name and Code	Threat	SCC
Riparian and Aquatic Ecosystems – All watershed scale DCs, Fine-scale DCs 1 & 2, Objective 1, All Standards, All Guidelines.	Cottonwood/Willow Group (CWG) Desert Willow Group (DWG) Montane-Conifer/Willow Group (MCWG) Walnut-Evergreen Tree Group (WEG) Wetland (Cienega) Group (WET)	Loss of riparian ecological condition due to changes in runoff or water levels (uncharacteristic fire effects) or diversion (none planned by the Gila NF).	Arizona Toad, Chiricahua Leopard Frog, Narrow-headed Gartersnake, Northern Mexican Gartersnake, Southwestern Willow Flycatcher, Western Yellow-billed Cuckoo, Gila Woodpecker, Lewis's Woodpecker, A Stonefly (*C. caryi*), Bearded Mountainsnail, "Gila" Mayfly (*L. dencyanna*), *A.c. argenticola, A.t. animorum, A.t. inermis, A.t. mutator*, Sonoran Snaggletooth Snail, Stonefly (*T. jacobii*), Whitewater Creek Woodlandsnail, Arizona montane vole, New Mexican meadow jumping mouse, Chiricahua Mountain Mudwort, Gooding's onion, Metcalfe's penstemon, Mimbres figwort, Mogollon clover, Wooton's hawthorn, Yellow lady's-slipper, Chihuahua Chub, Gila Chub, Gila Trout, Loach Minnow, Roundtail (Headwater) Chub, Spikedace, Rio Grande Sucker, Gila Springsnail, NM Hot Springsnail
Non-native Invasive Species – DC 1, Objectives 1-4, Standards 1-4, 6-10, & 12, Guidelines 1, 2, & 5-7.		Invasive species	Chiricahua Leopard Frog, Southwestern Willow Flycatcher, Western Yellow-billed Cuckoo, Chihuahua Chub, Gila Chub, Gila Trout, Loach Minnow, Roundtail (Headwater) Chub, Spikedace, Rio Grande Sucker, Gila Springsnail, NM Hot Springsnail, A Stonefly (*C. caryi*), "Gila" Mayfly (*L. dencyanna*), Stonefly (*T. jacobii*), Chiricahua Mountain Mudwort, Gooding's onion, Metcalfe's penstemon, Mimbres figwort, Mogollon clover, Wooton's hawthorn, Yellow lady's-slipper

Plan Component	Vegetation Name and Code	Threat	SCC
Watersheds – All DCs, Objectives, Standards, & Guidelines.		Sedimentation and soil compaction from roads and/or activities such as unauthorized use (no components developed for illegal activities).	Arizona Toad, Chiricahua Leopard Frog, Narrow-headed Gartersnake, Northern Mexican Gartersnake, Chihuahua Chub, Gila Chub, Gila Trout, Loach Minnow, Roundtail (Headwater) Chub, Spikedace, Rio Grande Sucker, A Stonefly (*C. caryi*), "Gila" Mayfly (*L. dencyanna*), Stonefly (*T. jacobii*), New Mexican meadow jumping mouse
Wildlife, Fish, and Plants DC 9, Non-native Invasive Species DC 1		Competition/predation/ hybridization by non-native aquatic species	Chiricahua Leopard Frog, Southwestern Willow Flycatcher, Western Yellow-billed Cuckoo, Chihuahua Chub, Gila Chub, Gila Trout, Loach Minnow, Roundtail (Headwater) Chub, Spikedace, Rio Grande Sucker, A Stonefly (*C. caryi*), "Gila" Mayfly (*L. dencyanna*), Stonefly (*T. jacobii*), Chiricahua Mountain Mudwort, Gooding's onion, Metcalfe's penstemon, Mimbres figwort, Mogollon clover, Wooton's hawthorn, Yellow lady's-slipper
Non-native Invasive Species Guideline 5		Disease	Arizona Toad, Chiricahua Leopard Frog, Chihuahua Chub, Gila Chub, Gila Trout, Loach Minnow, Roundtail (Headwater) Chub, Spikedace, Rio Grande Sucker

Fine Filter

While developed for federally listed species, there are plan components designed to reduce non-native fish and other aquatic species within native aquatic populations 4-6 stream reaches, and eradicate non-native fish populations to reduce impacts from predation/competition/hybridization from at least one stream reach containing a natural or constructed barrier in compliance with recovery plans during each 10-year period (Non-native Invasive Species OB-4 and 5, respectively). These objectives would further address threats to SCCs. Additionally, there is a fine filter plan component in the Non-native Invasive Species (GL7) resource section that specifically addresses the federally listed amphibian and reptile species that would also benefit the SCCs that use these habitat types. This guideline specifically states that any habitat or aquatic improvement and restoration projects within areas occupied by these species, as well as native fish species, there should be provisions to remove any non-native invasive animals.

Several management approaches have been identified in several resource area sections that would support the management these species. The following are two examples:

Coordinate with the NMDGF and USFWS regarding listed and native species, reintroductions, introductions, or transplants of listed or native species, control or eradication of non-native species, and the management of sport and native fishes, including the identification of refugia for native fish (that is, native only stream reaches). Work with the USFWS, NMDGF, and other partners to develop conservation measures (for example, public education to reduce human impacts) to prevent listing and to aid to in the recovery and delisting of federally listed species.

Seek to strengthen and develop programs to survey, monitor, and collect data on rare and endemic species, especially when basic distribution and species status information is lacking. Identify, document, and correct any management conflicts to the species or their habitat. Such efforts could include collaboration and agreements with local universities, community colleges, State and Federal agencies (for example, New Mexico Game and Fish Department, USFWS), and other nongovernmental organizations.

Table 33 identifies plan components that address threats listed above. These are just a few plan components that address threats, please refer to appendix D for a complete crosswalk.

Table 33. Plan components for non-native invasive species that address threats

Plan Component	Vegetation Name and Code	Threat	SCC
Non-native Invasive Species Guideline 7		Competition/predation/hybridization by non-native aquatic species	Chiricahua Leopard Frog, Northern Mexican Gartersnake, Narrow-headed Gartersnake, Chihuahua Chub, Gila Chub, Gila Trout, Loach Minnow, Roundtail (Headwater) Chub, Spikedace, Rio Grande Sucker

Determination: For species that use riparian and aquatic habitat, the ecosystem-level plan components should provide the ecological conditions necessary to maintain persistence for most species in the plan area. Those, along with species-specific plan components developed for federally listed species will also contribute toward maintaining persistence of SCCs using Riparian and Aquatic Habitat. The combination of ecosystem and species-specific plan components should provide the ecological conditions necessary to maintain persistence in the plan area.

Cliff, Caves, Mines, Rocky Features Associates:

See table 27 for species associated with these ERUs.

- Key Ecological Conditions: Rocky habitats, which provide nest/roost sites and adequate escape terrain, talus slopes, rocky outcrops, caves, or mine features (e.g., adits, shafts).
- Key Threats: Loss or disturbance of nest/roost sites, disturbance from recreational activities (e.g., climbing), mine closure/reclamation, mining or borrow activities, disease (e.g., white nose syndrome).

Both cliffs and talus slopes are inherently dynamic, subject to rock fall, ice, and wind and water erosion. Cliffs and rocky features (rock outcrops and talus slopes) are common in the mountainous West. They are found across a wide elevation range spanning cool alpine landscapes to desert environments, increasing scenic and biological diversity. The unique geology, geomorphology, and microclimates associated with cliffs, provide habitat for plants and animals adapted to a vertical environment. Ecosystem services, such as rock climbing, rock hounding, and mineral exploitation, are also associated with these features.

Cave resources and abandoned mines are present in varying densities across the Gila NF. A cave's suitability for bat roost and hibernacula is determined primarily by cave microclimate; particularly temperature and humidity, as well as protection from disturbance. Abandoned mines are the remains of former mining operations (see also Minerals section). The Forest Service's Abandoned Mine

Lands program identifies mine features posing a danger to the public, which are prioritized and identified for closure or remediation.

Cliffs, talus slopes, and caves are not likely departed from reference conditions and plan components for these features were developed to minimize impacts from management activities and human manipulation. Abandoned mines are human-made features that species have adapted to and use frequently. Plan components for these focus on public safety while also providing mitigation to enable them to continue to be used by wildlife if it can be done while still meeting public safety needs.

Coarse-filter

Persistence for species that use caves, mines, rocky features and cliff ecological condition is largely realized through the Cliffs and Rocky Features, Caves and Abandoned Mine Lands, Minerals, and Sustainable Recreation sections. Desired conditions for cliffs and rocky features (DC 1) as well as guidelines (GL 1 and 6), Caves and Abandoned Mine Lands (all plan components), Minerals (Locatable Minerals DC 1; GL 10), Salable/Mineral Materials (DC 2 and 3; STD 1; GL 7-9), and Wildlife, Fish, and Plants (DC 6) would all promote ecological conditions to support SCC plant and animal species, as well as minimize impacts to SCCs that use these habitat features. They will also help ensure mining activities will be compatible with ecosystem health and wildlife ecological condition needs, especially bats, providing protection from damage, disturbance and alteration.

Table 34 identifies plan components that address threats listed above. These are just a few plan components that address threats, please refer to appendix D for complete crosswalk.

Table 34. Plan components for cliff and rocky features that address threats

Plan Component	Vegetation Name and Code	Threat	SCC
Cliffs and Rocky Features All DCs and Guidelines.	Cave-like structures, Rocky features	Loss or disturbance of nest/roost sites, disturbance from recreational activities (e.g., climbing),	Mexican Spotted Owl, Lesser long-nosed bat, *Ashmunella cockerelli* (woodlandsnail), Bearded Mountainsnail, Black Range Mountainsnail (*O.m. acutidiscus*), Black Range Mountainsnail (*O.m. hermosensis*), Black Range Woodlandsnail, Cockerell Holospira Snail, Mineral Creek Mountainsnail, Morgan Creek Mountainsnail, *A.c. pertubosa, O.m. radiata, O.m. concentrica*, Silver Creek Woodlandsnail, Sonoran Snaggletooth Snail, Whitewater Creek Woodlandsnail, Cliff brittlebrush, Davidson’s cliff carrot, Hess’s fleabane, Metcalfe’s penstemon, Wright's Catchfly (campion), Gila morning glory, Mimbres figwort, Pinos Altos flame flower,

Fine-filter

Plan components were developed to mitigate disturbance from recreational rock climbing, provide protections from trampling of plants, protection to other species during the breeding season and at maternity roosts, and to minimize the spread of disease for at-risk species (Cliffs and Rocky Features GL 2-5; Caves and Abandoned Mine Lands DC 3, STD 2, GL 1-5; Locatable Minerals GL 10; and Salable/Mineral Materials DC 2 and 3, STD 1, and GL 9; Dispersed Recreation GL 3).

Management approaches have been identified in several resource area sections that would support the management these species. The following are examples:

The forest seeks opportunities to collaborate with others to raise awareness and valuation of cliffs and rocky features, especially as it pertains to at-risk, rare and endemic species. This includes engaging climbing organizations in seasonal surveys and targeted monitoring, closures and collaborative education programs that provide public information on how to minimize impacts (for example, not installing permanent hardware or disrupting life functions of various species). The forest also supports research that fills information gaps on the rare and endemic species that use cliffs and rocky features, as more knowledge can improve management.

Currently, neither the cause nor the transmission of white-nose syndrome is well understood; however, it is known that a cave or abandoned mine environment containing this fungus is infectious to hibernating bats. The forest seeks opportunities to develop of a response plan for white-nose syndrome through continued collaboration with the USFWS, Bat Conservation International, New Mexico Department of Game and Fish (NMDGF), the National Speleological Society, and others with interests in conservation management for bat species. The forest also seeks collaborative opportunities to increase awareness of white-nose syndrome and other pathogens at local and regional levels that includes a focus on best management practices for the prevention of outbreaks.

The forest would like to prepare cave management plans for all caves, especially those with important resource, educational or recreational values, hazardous conditions or heavy use. These plans would include information on appropriate use, necessary restrictions and monitoring. The forest seeks opportunities to foster the collaboration and exchange of information between governmental agencies, partners, and other stakeholders to address conservation, interpretation and education for cave resources, grottos, and associated species. This includes engage caving organizations in cave management activities, such as seasonal surveys, inventory, monitoring, mapping, closures, and wildlife-friendly gate development at specific sites.

The forest prioritizes areas for floristic surveys by focusing on rare soil types, geological features, or biodiversity hotspots. Geographic Information Systems (GIS) is the preferred database of record for rare and endemic species observations and population locations.

Table 35 identifies plan components that address threats listed above. These are just a few plan components that address threats, please refer to appendix D for complete crosswalk.

Table 35. Plan components for caves and abandoned mine lands that address threats

Plan Component	Vegetation Name and Code	Threat	SCC
Caves and Abandoned Mine Lands DC 2	Caves, Mines	Mine closure/reclamation, mining or borrow activities	Mexican Spotted Owl, Lesser Long-nosed Bat
Caves and Abandoned Mine Lands Guideline 3	Caves, Mines	Disease (e.g., white-nose syndrome).	Lesser Long-nosed Bat

Determination: For all species that use Cliff, Caves, Mines, and Rocky Features, the ecosystem-level plan components likely provide most of the ecological conditions necessary to maintain persistence for species in the plan area. Additional fine-scale plan components have been developed to further provide protections for various aspects of management and forest use. The combination of ecosystem and fine scale plan components should provide the ecological conditions necessary to maintain persistence in the plan area for SCCs that use these areas.

Special Habitat Features

(Like coarse woody debris, snags, flowering plants, rocky riparian areas with deciduous leaf litter, and soil parent material)

(All Upland and Riparian ERUs): See table 27 for species associated with these ERUs.

- Key Threats: Vegetation management, fuelwood collection, wildfire, insect outbreaks, or drought outside the natural range of variability, flooding from uncharacteristic fire in uplands, and climate change.

While rocky riparian areas with deciduous leaf litter and soil parent material are listed as special habitat features, the plan components described in the Riparian and Aquatic Associates section above, as well as other upland vegetation plan components developed and described earlier will provide for the deciduous leaf litter in riparian areas across the forest. Soil parent material is important, particularly for plant species; however, this is not something that we can change on the landscape. It is simply a characteristic that would define areas where certain species could occur and could be mapped. Plan components developed for promoting desired ecological conditions would then be incorporated to provide conditions necessary for habitat and species persistence.

Coarse filter

Many of the species that need diverse forest structure and old growth components are also dependent on large trees, coarse woody debris, snags, and tree-related components for roosting, foraging, and nesting. Downed woody material and logs provide important ecological condition for small mammal prey species. In addition to the components described above these species would also benefit from a number of ecosystem-level plan components, which would protect these key ecological conditions. Coarse-filter plan components that would benefit the majority of species that depend on these vegetation communities include desired conditions to maintain appropriate levels of old trees, snags, nesting structures, and downed wood at multiple spatial scales. Forest-wide desired conditions for the different vegetation communities include the landscape-scale (SFF DC 3 and 4, MCW DC 3 and 4, and MCD DC 3-5) and mid-scale (SFF DC 3 and 4, MCW DC 3 and 4, MCD DC 4 and 5) plan components. Plan components were developed similar to these for all Forested, Woodland, and Riparian ERUs.

There are also plan components that balance the needs of multiple use with wildlife species that need large trees and snags, reduce the threats of uncharacteristic fire effects, and provide for increased resiliency (Timber, Forest and Botanical Products DC 1a-c, STD 7a). Fuelwood gathering has been a long and much valued tradition and important for heating homes and cooking. Desired Condition 2 in the Community Relationships section of the plan addresses the need to balance fuelwood gathering activities with available resource capacity. Plan components within several sections (Soils DC 1c; Riparian and Aquatic Ecosystems DC 1-3, STD 3, GL 4; Wildland Fire and Fuels Management DC 5b, GL 1 and 3) would ensure sufficient levels of woody debris are maintained during projects and would mitigate negative effects that occur from ground disturbing activities and wildland fire that can cause soil loss, erosion, or loss of woody debris getting to riparian areas from the uplands.

Table 36 identifies plan components that address threats listed above. These are just a few plan components that address threats, please refer to appendix D for complete crosswalk.

Table 36. Plan components for all upland ERUS and riparian aquatic ecosystems that address threats

Plan Component	Vegetation Name and Code	Threat	SCC
All Upland ERUs DCs, standards, and guidelines. Riparian and Aquatic Ecosystems – All watershed scale DCs, Fine-scale DCs 1 & 2, Objective 1, All Standards, All Guidelines.	Special Habitat Features (like coarse woody debris (CWD), snags, flowering plants, rocky riparian areas with deciduous leaf litter, and soil parent material)	Vegetation management, fuelwood collection, wildfire, insect outbreaks, or drought outside the natural range of variability, flooding from uncharacteristic fire in uplands, and climate change.	Marsh slug snail, nitocris fritillary butterfly, western bumblebee, Gooding’s onion, heartleaf groundsel, Hess’s fleabane, Mogollon death camas, Mogollon hawkweed, Mogollon Mountain lousewort, Porsild’s starwort, yellow lady’s-slipper, Arizona montane vole, Arizona toad, Lewis’s woodpecker, Iron Creek woodlandsnail, Silver Creek woodlandsnail, Arizona crested-coralroot, Gila morning glory, Mimbres figwort, Mogollon clover, Pinos Altos flame flower, *Oreohelix metcalfei acutidiscus* (mountainsnail), *O. m. hermosensis* (mountainsnail), *Ashmunella cockerelli* (woodlandsnail), Cockerell holospira snail, Iron Creek woodlandsnail, Mineral Creek mountainsnail, *A. c. perobtusa* (snail), *O. m. radiata* (snail), *O. m. concentrica* (snail), Gila morning glory, Greene’s milkweed, Ray Turner’s spurge, Wright’s dogweed, Gunnison’s prairie dog, lesser long-nosed bat Arizona Toad, Chiricahua Leopard Frog, Narrow-headed Gartersnake, Northern Mexican Gartersnake, Southwestern Willow Flycatcher, Western Yellow-billed Cuckoo, Gila Woodpecker, A Stonefly (C. caryi), Bearded Mountainsnail, “Gila” Mayfly (*L. dencyanna), A.c. argenticola, A.t. animorum, A.t. inermis, A.t. mutator*, Sonoran Snaggletooth Snail, Stonefly (*T. jacobii*), Whitewater Creek Woodlandsnail, Arizona montane vole,

Plan Component	Vegetation Name and Code	Threat	SCC
			New Mexican meadow jumping mouse, Chiricahua Mountain Mudwort, Metcalfe's penstemon, Mimbres figwort, Mogollon clover, Wooton's hawthorn, Yellow lady's-slipper, Chihuahua Chub, Gila Chub, Gila Trout, Loach Minnow, Roundtail (Headwater) Chub, Spikedace, Rio Grande Sucker, Gila Springsnail, NM Hot Springsnail

Fine filter

All of the special habitat features would be provided for through plan components identified in the course filter and throughout the forest plan itself. However, there is a desired condition in the Wildlife, Fish, and Plants section (DC 11) that specifically addresses flowering plants and pollinators. This plan component in conjunction with many other plan components throughout the plan would provide for flowering plants necessary for persistence of species that rely upon them as food sources and host plants.

Determination: For species that depend on the Special Habitat Features, the ecosystem-level plan components should provide the ecological conditions necessary to maintain persistence for most species in the plan area. However, an additional plan component was developed to maintain persistence of pollinators, particularly the western bumblebee. The combination of ecosystem and species-specific plan components should provide the ecological conditions necessary to maintain species persistence in the plan area.

Multiple Vegetation communities

Several species like Arizona toad, Lewis's woodpecker, and several of the land snails use a variety of ERUs and ecological conditions. Key ecological conditions for the land snails were addressed above under Cliffs and Rocky Features. For the toad and woodpecker, the key ecological conditions includes lotic water and large snags, respectively. These needs would be provided for largely through plan components under Riparian/Aquatic Associates and Forested and Woodland ERUs. Plan components within the Forested and Woodland ERUs would also provide benefits to all of the above listed species as well and serve to improve the likelihood of persistence to the species. Table 37 identifies a few plan components that identified threats. Please refer to appendix D for a complete crosswalk.

Table 37. Plan components for multiple vegetation communities that identify threats

Plan Component	Vegetation Name and Code	Threat	SCC
All Upland ERUs DCs, standards, and guidelines. Riparian and Aquatic Ecosystems – All watershed scale DCs, Fine-scale DCs 1 & 2, Objective 1, All Standards, All Guidelines. DCs, Standards, and Guidelines listed throughout Draft Forest Plan. Please refer to Appendix D for complete crosswalk.	Multiple Vegetation Communities	Many listed throughout analyses above.	Marsh slug snail, nitocris fritillary butterfly, western bumblebee, Gooding's onion, heartleaf groundsel, Hess's fleabane, Mogollon death camas, Mogollon hawkweed, Mogollon Mountain lousewort, Porsild's starwort, yellow lady's-slipper, Arizona montane vole, Arizona toad, Lewis's woodpecker, Iron Creek woodlandsnail, Silver Creek woodlandsnail, Arizona crested-coralroot, Gila morning glory, Mimbres figwort, Mogollon clover, Pinos Altos flame flower, *Oreohelix metcalfei acutidiscus* (mountainsnail), *O. m. hermosensis* (mountainsnail), *Ashmunella cockerelli* (woodlandsnail), Cockerell holospira snail, Iron Creek woodlandsnail, Mineral Creek mountainsnail, *A. c. perobtusa* (snail), *O. m. radiata* (snail), *O. m. concentrica* (snail), Gila morning glory, Greene's milkweed, Ray Turner's spurge, Wright's dogweed, Gunnison's prairie dog, lesser long-nosed bat, Arizona Toad, Chiricahua Leopard Frog, Narrow-headed Gartersnake, Northern Mexican Gartersnake, Southwestern Willow Flycatcher, Western Yellow-billed Cuckoo, Gila Woodpecker, A Stonefly (*C. caryi*), Bearded Mountainsnail, "Gila" Mayfly (*L. dencyanna), A.c. argenticola, A.t. animorum, A.t. inermis, A.t. mutator,* Sonoran Snaggletooth Snail, Stonefly (*T. jacobii*), Whitewater Creek Woodlandsnail, Arizona montane vole, New Mexican meadow jumping mouse, Chiricahua Mountain Mudwort, Metcalfe's penstemon, Mimbres figwort, Mogollon clover, Wooton's hawthorn, Yellow lady's-slipper, Chihuahua Chub, Gila Chub, Gila Trout, Loach Minnow, Roundtail (Headwater) Chub, Spikedace, Rio Grande Sucker, Gila Springsnail, NM Hot Springsnail

Environmental Consequences for Species of Conservation Concern – Alternatives 2 and 5

Alternatives 2 and 5 retain relevant plan direction from alternative 1, but are more responsive to current science and thinking while addressing the core themes and significant issues explored during the plan revision process. The differences between alternatives 2 and 5 is the amount of recommended wilderness, which was discussed in the effects common to all action alternatives, the addition of three botanical areas and their acreage amounts, and differences in acreage amounts treated through mechanical cutting and wildland fire (table 28).

Botanical areas are proposed under alternatives 2 and 5, and the acreage amount of proposed botanical areas vary by alternative as shown in table 38:

Table 38. Acres within proposed botanical areas, by alternative

Alternative	Mogollon Mountains	Pinos Altos Range	Emory Pass
2	45,029	6,198	16,944
5	98,510	20,930	31,150

Plan components for the proposed botanical areas focus on promoting values of rare and endemic plant populations while providing opportunities for stakeholder engagement and education. No new permanent motorized routes will be constructed within the proposed botanical areas and maintenance on existing routes will minimize ground disturbance outside existing road prism and associated drainage features. Designated camping areas will be delineated in the botanical areas that are located outside of designated wilderness and should include educational, interpretive signage. Additionally, the use of non-selective herbicides or herbicides that may have activity on rare and endemic plant species will not occur in special botanical areas unless it is to control or eradicate noxious weed species, and other integrated pest management efforts have failed or are not likely to be successful. If such herbicide use is necessary, mitigation plans to minimize impacts to rare and endemic species populations will be developed and implemented. The plan components provided for the proposed botanical areas would benefit rare and endemic plants by bringing an awareness to their value, but also to other species that occur within them that could potentially be impacted by human disturbance through roads or dispersed camping, as well as any impacts from herbicide use. All other plan components would remain the same as those listed under All Action Alternatives.

Alternatives 2 and 5 would primarily differ from alternative 1 in the rate, magnitude, and method of ecological condition restored. Alternative 2 contains objectives to treat all ERUs except Piñon-Juniper Woodland (PJO) to a much greater extent than alternative 1 using both mechanical treatment methods, as well as both naturally ignited wildfire and prescribed fire. Alternative 5 on the other hand, would have no treatment objectives in Spruce-Fir Forest (SFF), Mixed Conifer with Aspen (MCW), or PJO. Acreage treated in alternative 5 are similar to alternative 2 treatment acreage amounts, however, alternative 5 would utilize naturally ignited wildfire and prescribed fire only, except in the wildland-urban interface (WUI) where mechanical treatment methods could be used. The increased amount of treated acres in both of the alternatives could lead to an increase in the amount of habitat affected during restoration activities. This would lead to more acreage that would be more resilient to changes from uncharacteristic fire and climate change. See table 28 for acreages and methods.

Ecological conditions, threats and plan components described in the previous section for All Action Alternatives would apply to these alternatives. All grassland and woodland ERUs show some improvement in their departure percentages with PJO going from moderate departure of 36 percent to low departure of 33 percent in alternative 2, while alternative 5 stays moderately departed but goes to departure of 41 percent. All other departures remain in the same departure rating category (low, moderate, or high) for all these ERUs. All forested ERUs show improvement with all but PPE staying within the same departure rating (low, moderate, or high) but showing some improvement in the percentage. The only exception of a change in the departure rating is for PPE that goes from a moderate departure of 43 percent to a low departure of 30 percent in alternative 2 and 28 percent in alternative 5.

Riparian habitat includes wetlands and forested riparian (i.e., willow, cottonwood, and sycamore) areas surrounding seeps/springs, perennial streams, lakes, and other water features. According to the Gila NF Final Assessment (USDA FS Gila NF 2017), riparian habitat occupies a very small portion of the forest and riparian conditions range from low to moderate departure, so maintaining the low departure riparian systems while improving the moderately departed riparian systems would likely improve ecological conditions for these species. Preferential treatment will be given to riparian and aquatic resources (Riparian and Aquatic Ecosystems GL 6) in the forest for alternatives 2 and 5. These species would benefit from plan components that maintain or improve riparian and aquatic conditions toward reference conditions.

Moving toward desired conditions would improve ecological conditions necessary to maintain persistence for these species by decreasing sedimentation and improving seral state distribution, surface flow timing and duration, and repairing disconnected floodplains (see Riparian and Aquatic Ecosystems). Plan components discussed under All Action Alternatives would help to offset any potential impacts from these actions. Desired conditions would be achieved at a faster rate than alternative 1, and alternatives 2 and 5 would increase outcomes in terms of improving stream health, riparian habitat, and wetland integrity compared to alternative 1. These alternatives would maintain SCC persistence within the plan area.

Environmental Consequences for Species of Conservation Concern – Alternative 3

Alternative 3 was developed to respond to issues by placing more emphasis on mechanically treating grassland and open woodland vegetation to maintain or move toward desired conditions for those vegetation types. These efforts would prioritize restoring understory vegetation that could be used as forage for livestock grazing, which contributes to local and regional economic sustainability. The differences with this alternative is the amount of recommended wilderness, which was discussed in the effects common to all action alternatives, and differences in acreage amounts and ERUs emphasized to be treated through mechanical cutting and wildland fire which would be limited in its use. The acreages are shown in table 28 are less than the acreages for alternatives 2 and 5 because most of the treatments would be mechanical. These treatment types are more expensive than managing naturally ignited wildfire or prescribed fire and acreage was based on the average of congressionally appropriated dollars over the last 10 years. Management activities and permitted uses would maintain riparian management zones in, or trending toward proper functioning condition. There would be an emphasis in utilizing guidelines rather than standards for livestock grazing plan direction, and vacant allotments would be stocked to the maximum extent possible. Land adjustments would be balanced so that no-net loss of private property in a county occurred. Wilderness recommendations would be avoided in areas identified as needing restoration in grassland and open woodland vegetation, and areas providing access to traditional recreational, cultural, and historical uses of the forest. All other plan components would remain the same as those listed under All Action Alternatives. In addition to the environmental consequences for all alternatives above, alternative 3 would primarily differ from alternative 1 in the rate, magnitude, and ERU types of ecological condition restored overall.

Alternative 3 has very little prescribed fire proposed and no objective for using naturally ignited wildfire in this alternative. The amount of treatments within all the grasslands combined for this alternative would equate to approximately 25,800 acres of mechanical and 1,250 acres of prescribed fire (27,050 acres total treatment) over a 10-year period. These acreages are quite a bit less than any other alternative being analyzed and only about 300 acres less than alternative 1. The difference between alternative 1 and this alternative are that many acres were treated using prescribed fire (approximately 5,854 acres) and naturally ignited wildfire (approximately 13,476 acres) with only

8,004 acres treated mechanically (27,334 acres total treatment) over a 10-year period. In the open woodlands 32,000 acres of mechanical and 1,000 acres of prescribed fire are proposed over a 10-year period. This is more than alternative 1 had accomplished in the last 10-year period but considerably less than any other action alternative.

Desired conditions for Colorado Plateau-Great Basin (CPGB) and Montane-Subalpine Grassland (MSG) have a slightly improved departure percentage from 65 percent and 64 percent, but both still moderate at 61 percent and 62 percent, respectively. Semi-Desert Grassland (SDG) slightly increases departure percentage from 94 percent to 95 percent and remains highly departed from desired conditions. Piñon-Juniper Grass Woodland (PJG) remains in low departure going from 29 percent to 21 percent departure, while Juniper Grass Woodlands (JUG) remains at a moderate departure rating going from 39 percent to 40 percent departure.

For species that depend on these ecosystems, this alternative would overall slightly improve conditions in the grassland and open woodland ERUs. Not much restoration work would occur within any of the forested ERUs as there are no objectives proposed for them in this alternative, so their ecological conditions are likely to remain the same or decline in ecological condition impacting SCCs that use these ERUs. Since this alternative focuses on mechanical treatments in the grassland and woodland ERUs, this would result in an increased amount of ground disturbance and associated effects to understory vegetation in those areas, but also improve resiliency toward any uncharacteristic events and climate change. Localized, short-term impacts to soil stability and erodibility, with subsequent watershed impacts such as increased sedimentation, would be more likely and could affect riparian and aquatic areas occurring adjacent to these ERUs. Moving toward desired conditions would improve ecological conditions necessary to maintain persistence for these species with the implementation of plan components by decreasing sedimentation and improving seral state distribution, surface flow timing and duration, and repairing disconnected floodplains (see Riparian and Aquatic Ecosystems section). There may be higher probability of localized invasive species distribution and establishment in those disturbed areas that could potentially affect plants listed as SCCs. There may also be an increase in the number of livestock on the landscape as vacant allotments would be stocked, thus offsetting the benefits of the restoration work in these ERUs.

Plan components discussed under All Action Alternatives would help to offset any potential impacts from these actions. Desired conditions would be achieved at a similar rate as alternative 1 within the grassland and open woodland ERUs and slower in forested ERUs, but alternative 3 would increase outcomes in terms of improving stream health, riparian habitat, and wetland integrity compared to alternative 1. This alternative would maintain SCC persistence within the plan area based on continued overall improvement of departure percentages toward desired conditions.

Environmental Consequences for Species of Conservation Concern – Alternative 4

Alternative 4 was developed to respond to issues by placing more emphasis on mechanically treating forested/timberland vegetation to maintain or move toward desired conditions. These efforts would prioritize restoring forested vegetation that could also produce forest products, which contributes to local and regional economic sustainability. The differences with this alternative is the amount of recommended wilderness, which was discussed in the effects common to all action alternatives, and differences in acreage amounts and ERUs emphasized to be treated through mechanical cutting and prescribed fire which would be limited in its use. The acreages are shown in table 28 are less than the acreages for alternatives 2 and 5 because most of the treatments would be mechanical. These treatment types are more expensive than managing naturally ignited wildfire or prescribed fire and acreage was based on the average of congressionally appropriated dollars over the last 10 years.

Management activities and permitted uses would maintain riparian management zones in, or trending toward proper functioning condition. There would be an emphasis in utilizing guidelines rather than standards for livestock grazing plan direction, and vacant allotments would be stocked to the maximum extent possible. Land adjustments would be balanced so that no-net loss of private property in a county occurred. Wilderness recommendations would be avoided in areas identified as needing restoration in forested vegetation or being suitable for timber production, and areas providing access to traditional recreational, cultural, and historical uses of the forest. All other plan components would remain the same as those listed under All Action Alternatives. In addition to the environmental consequences for all alternatives above, alternative 4 would primarily differ from alternative 1 in the rate, magnitude, and ERU types of ecological condition restored overall.

Alternative 4 has very little prescribed fire proposed and no objective for using naturally ignited wildfire in this alternative. The amount of treatments within all the forested ERUs combined for this alternative would equate to approximately 52,030 acres of mechanical and 16,620 acres of prescribed fire (68,650 acres total treatment) over a 10-year period. The difference between alternative 1 and this alternative are that many acres were treated using prescribed fire (approximately 88,791 acres) and naturally ignited wildfire (approximately 119,688 acres) with only 14,220 acres treated mechanically (222,699 acres total treatment) over a 10-year period. By comparison, the other action alternatives that have objectives for treatment in the forested ERUs enable the forest to treat up to 282,400 acres in the Mixed Conifer-Frequent Fire (MCD) ERU alone, using a combination of mechanical, naturally ignited, and prescribed fire treatment methods.

Desired conditions for all forested ERUs either remain the same (55 percent in MCD) or move closer toward desired conditions for the rest of the ERUs. While they do move closer toward desired conditions, all ratings remain in the current condition departure rating category (high departure for PPF 77 percent, moderate for the rest) except for MCW. MCW departure rating improves from moderately departed 40 percent to a low departure rating of 30 percent over the next 10-year period. There are no objectives for any grassland or open woodland ERUs in this alternative, so little if any restoration work is likely to take place within these areas. As a result, the departure percentages remain fairly constant with one ERU (PJG) moving away from desired conditions from 39 percent to 44 percent departure.

For species that depend on these ecosystems, this alternative would overall slightly improve conditions in the forested ERUs. Not much restoration work would occur within any of the grassland or open woodland ERUs as there are no objectives proposed for them in this alternative, so their ecological conditions are likely to remain the same or decline in ecological condition impacting SCCs that use these ERUs. Since this alternative focuses on mechanical treatments in the forested ERUs, this would result in an increased amount of ground disturbance and associated effects to understory vegetation in those areas. Localized, short-term impacts to soil stability and erodibility, with subsequent watershed impacts such as increased sedimentation, would be more likely and could impact riparian and aquatic areas occurring adjacent to these ERUs. Moving toward desired conditions would improve ecological conditions necessary to maintain persistence for these species by decreasing sedimentation and improving seral state distribution, surface flow timing and duration, and repairing disconnected floodplains (see Riparian and Aquatic Ecosystems). There may be higher probability of localized invasive species distribution and establishment in those disturbed areas that could potentially impact plants listed as SCCs. There may also be an increase in the number of livestock on the landscape as vacant allotments would be stocked, thus offsetting the benefits of the restoration work in these ERUs. Plan components discussed under All Action Alternatives would help to offset any potential impacts from these actions. Desired conditions would be achieved at a slower rate than alternative 1 even in the forested ERUs because less acreage treated at the higher cost of mechanical treatment, but alternative 4 would increase outcomes in terms of improving stream health, riparian habitat, and wetland integrity compared to alternative 1. This alternative would maintain SCC persistence within the plan area based on continued overall improvement of departure percentages toward desired conditions.

Regional Forester's Sensitive Species

The Regional Forester's sensitive species program is the Forest Service's dedicated initiative to conserve and recover plant and animal species according to Forest Service policy (FSM 2670). The Gila NF improves habitat and restore ecosystems for sensitive species through vegetation treatments and management practices. Sensitive species are those plant and animal species identified by a regional forester for which population viability is a concern, as evidenced by the following:

- Significant current or predicted downward trends in population numbers or density
- Significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

There are 69 regionally sensitive species known to occur in the Gila NF spread across all six ranger districts as shown in table 39, which also shows the amount of habitat potentially available by vegetation community. Information in the table is derived from the Ecological Assessment (USDA FS Gila NF 2017), Gila National Forest GIS files, and the VDDT model runs from the vegetation analysis.

Table 39. Regionally sensitive species and primary habitat needs

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
Birds				
Northern goshawk	*Accipiter gentilis*	Multi-storied canopy	PPE, PPF, MCD, MCW	1,578,006 acres
Burrowing owl	*Athene cunicularia hypugaea*	Prairie dog or other burrows	Grassland ERUs	258,790 acres
Common blackhawk	*Buteogallus anthracinus*	Large gallery cottonwood and sycamore	Riparian	31,252 acres
Costa's hummingbird	*Calypte costae*	Xeric hillside vegetation near riparian habitat	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group 8,929 acres Desert willow group 918 springs/seeps 2,718 acres of non-riverine wetlands
Common ground dove	*Colubina passerina*	Riparian shrubs and weedy areas	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group 8,929 acres Desert willow group 918 springs/seeps 2,718 acres of non-riverine wetlands
American peregrine falcon	*Falco peregrinus anatum*	Rocky cliffs	Woodland to Forested ERUs	2,860,513 acres with an unknown number of cliff and rocky sites

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
White-eared hummingbird	*Hylocharis leucotis*	Pine-oak forests near flower banks	PPE, PPF	1,080,528 acres
Gila woodpecker	*Melanerpes uropygialis*	Large snags, riparian	Riparian with large cottonwood/ sycamore	31,252 acres
Abert's towhee	*Melozone aberti*	Woodlands and thickets along rivers and streams	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group 8,929 acres Desert willow group
Arizona Bell's vireo	*Vireo bellii arizonae*	Desert shrubland/woodland in lowland stream courses	Riparian	31,252 acres Cottonwood/sycamore group 1,655 acres Walnut/evergreen tree group 8,929 acres Desert willow group
Gray vireo	*Vireo vicinior*	Piñon juniper savannahs and woodlands	Woodland ERUs	1,282,507 acres
Fish				
Desert sucker	*Catostomus clarkia*	Aquatic	Riparian	957 miles of perennial stream
Sonora sucker	*Catostomus insignis*	Aquatic	Riparian	957 miles of perennial stream
Rio Grande sucker	*Catostomus plebeius*	Aquatic	Riparian	957 miles of perennial stream
Roundtail (Headwater) Chub	*Gila robusta*	Aquatic	Riparian	957 miles of perennial stream
Rio Grande cutthroat trout	*Oncorhynchus clarki virginalis*	Aquatic	Riparian	957 miles of perennial stream

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
Invertebrates				
A Stonefly	*Capnia caryi*	Aquatic	Riparian	957 miles of perennial stream 546 miles of intermittent stream
Dashed ringtail	*Erpetogomphus heterodon*	Aquatic	Riparian	957 miles of perennial stream 546 miles of intermittent stream
Notodontid moth	*Euhyparpax rosea*	Unknown	Unknown	Unknown
"Gila" May Fly	*Lachlania dencyanna*	Aquatic	Riparian	957 miles of perennial stream 546 miles of intermittent stream
Bearded Mountainsnail	*Oreohelix barbata*	Riparian with deciduous leaf litter in rocks	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group
Black Range Mountainsnail	*Oreohelix metcalfei acutidiscus*	Igneous rock, limestone talus or outcrops	Woodland ERUs	1,282,507 acres with unknown number of outcrops
Black Range Woodlandsnail	*Ashmunella cockerelli*	Igneous rock, limestone talus or outcrops	Woodland ERUs	1,282,507 acres with unknown number of outcrops
Gila Springsnail	*Pyrgulopsis gilae*	Cool to warm springs in rhyolite fissures by Gila River	Riparian	918 springs/seeps
Iron Creek Woodlandsnail	*Ashmunella mendax*	Wooded zones of Black Range	PJO, PPE, PPF, MCD, MCW	530,019 acres
Mineral Creek Mountainsnail	*Oreohelix pilsbryi*	Igneous rock, limestone talus or outcrops	Woodland ERUs	1,282,507 acres with unknown number of outcrops

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
Morgan Creek Mountainsnail	*Oreohelix swopei*	Riparian with deciduous leaf litter in rocks	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group
New Mexico Hot Springsnail	*Pyrgulopsis thermalis*	Thermal springs along Gila River, aquatic	Riparian	918 springs/seeps
No Common Name Snail	*Ashmunella cockerelli argenticola*	Riparian with deciduous leaf litter in rocks	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group
No Common Name Snail	*Ashmunella cockerelli perobtusa*	Igneous rock, limestone talus or outcrops	Woodland ERUs	1,282,507 acres with unknown number of outcrops
No Common Name Snail	*Ashmunella tetrodon animorum*	Riparian with deciduous leaf litter in rocks	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group
No Common Name Snail	*Ashmunella tetrodon inermis*	Riparian with deciduous leaf litter in rocks	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group
No Common Name Snail	*Ashmunella tetrodon mutator*	Riparian with deciduous leaf litter in rocks	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
Dry Creek Woodland Snail	*Ashmunella tetrodon tetrodon*	Riparian with deciduous leaf litter in rocks	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group
No Common Name Snail	*Oreohelix metcalfei radiata*	Igneous rock, limestone talus or outcrops	Woodland ERUs	1,282,507 acres with unknown number of outcrops
No Common Name (Black Range mountainsnail)	*Oreohelix metcalfei concentrica*	Igneous rock, limestone talus or outcrops	Woodland ERUs	1,282,507 acres with unknown number of outcrops
No Common Name Snail	*Oreohelix metcalfei metcalfei*	Igneous rock, limestone talus or outcrops	Woodland ERUs	1,282,507 acres with unknown number of outcrops
Silver Creek Woodlandsnail	*Ashmunella binneyi*	Rocky outcrops	PPF, MCD	1,079,561 acres with unknown number of outcrops
Whitewater Creek Woodlandsnail	*Ashmunella danielsi*	Riparian with deciduous leaf litter in rocks	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group
Plants				
Arizona Crested-Coralroot	*Hexalectris arizonica*	Heavy litter in oak, pine, or juniper	PJO, MPO, PPE, PPF	1,946,329 acres
Davidson's Cliff Carrot	*Pteryxia davidsonii*	Sheer, rocky north facing cliffs	Woodland ERUs	1,282,507 acres with unknown number of north facing cliffs and outcrops

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
Gila Thistle	*Cirsium gilense*	Moist areas, mountain meadows in montane coniferous forest	PPF, MCD	1,079,561 acres with unknown number of moist, montane meadows 5,808 acres Montane conifer/willow group 918 springs/seeps 2,718 acres of non-riverine wetlands
Gooding's Onion	*Allium gooddingii*	Under canopy of mixed conifer forest	MCD, MCW, SFF, Riparian	521,257 acres 5,808 acres Montane conifer/willow group
Greene Milkweed	*Asclepias uncialis* ssp. *uncialis*	Grasslands sandy to rocky soils 5,000-7,000 ft elevation	CPGB, JUG	165,924 acres
Heartleaf Groundsel	*Packera cardamine (=Senecio cardamine)*	Understory of mixed conifer and spruce/fir	MCW, SFF	125,013 acres
Hess's Fleabane	*Erigeron hessii*	Exposed rock or rocky outcrops	MCW, SFF	125,013 acres with unknown number of rocky outcrops
Maguire’s Beardtongue	*Penstemon linarioides spp. maguirei*	Sandy soil	PJO limestone cliffs	848,440 acres with unknown number of limestone cliffs
Metcalfe's Penstemon	*Penstemon metcalfei*	Cliffs and steep slopes	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group
Metcalfe’s Tick-trefoil	*Desmodium metcalfei*	Rocky slopes	Grassland ERUs and PJO	1,107,230 acres with unknown amount of rocky slopes

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
Mimbres Figwort	*Scrophularia macrantha*	North-facing slopes	PJO, PPE, PPF, MCD Riparian	2,325,212 acres with unknown amount in north aspects
Mogollon Clover	*Trifolium neurophyllum*	Aquatic, wet meadows, springs	PPF, MCD, Riparian	1,079,561 acres with unknown number of wet meadows 5,808 acres Montane conifer/willow group 918 springs/seeps 2,718 acres of non-riverine wetlands
Mogollon Death Camas	*Zigadenus mogollonensis*	Understory of wet mixed conifer and spruce/fir	MCW, SFF	125,013 acres
Mogollon Hawkweed	*Hieracium brevipilum (=H. fendleri* var. *mogollense)*	Understory of pine and mixed conifer	PPF, MCD, MCW	226,247 acres
Pinos Altos Flame Flower	*Talinum humile*	Rocky south facing slopes over rhyolite	PJO, MPO, PPE	1,263,012 acres with unknown amount of south facing slopes over rhyolite
Porsild's Starwort	*Stellaria porsildii*	Understory of mixed conifer	PPF, MCD, MCW	226,247 acres
Rusby Hawkweed	*Hieracium abscissum (=H. rusbyi)*	Understory of mixed conifer	MCD, MCW, SFF	521,257 acres
Villous Groundcover Milkvetch	*Astragalus humistratus var. crispulus*	Xeric pine on sandy volcanic soils	CPGB, JUG, PJO, PPE	1,411,575 acres with unknown amount on sandy, volcanic soils

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
Wooton's Hawthorn	*Crataegus wootoniana*	Riparian habitat in montane conifer forest 6,500-8,000 ft elevation	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group 918 springs/seeps 2,718 acres of non-riverine wetlands
Wright's Dogweed	*Adenophyllum wrightii* var. *wrightii*	Sandy, silty soils in swales or drainages	PJG, PJO	1,151,149 acres with unknown amount of sandy, silty soils
Yellow Lady's-Slipper	*Cypripedium parviflorum* var. *pubescens*	Mesic meadows and wet streamsides	PPF, MCD, MCW	226,247 acres with unknown amount of wet meadows 5,808 acres Montane conifer/willow group 918 springs/seeps 2,718 acres of non-riverine wetlands
Mammals				
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	Caves and mines	Most ERUs on forest	Unknown number of caves and 353 documented mines
Gunnison's Prairie Dog (prairie population)	*Cynomys gunnisoni*	Open grasslands and shrublands	MSG, CPGB, PJG, JUG	590,016 acres
Gunnison's Prairie Dog (montane population)	*Cynomys gunnisoni pop. 1*	Open grasslands and shrublands	MSG, CPGB, PJG, JUG	590,016 acres
Spotted Bat	*Euderma maculatum*	Cliffs	Multiple ERUs	Unknown amount of cliff habitat
Allen's Lappet-browed Bat	*Idionycteris phyllotis*	Rocky slopes and cliffs	Riparian, woodland ERUs, PPE, PPF	3,026,857 acres with unknown amount of rocky slopes and cliffs

Common Name	Scientific Name	Special Habitat Features	Ecological Response Unit (ERU)	Potentially Suitable Habitat or Features Forestwide
Western Red Bat	*Lasiurus blossevillii*	Riparian areas and caves	Riparian, grassland and woodland ERUs	1,541,297 acres with unknown number of caves and 353 documented mines
Hooded Skunk	*Mephitis macroura milleri*	Rock/talus scree, low riparian, desert, low grasslands and low woodlands	Grassland and woodland ERUs	1,541,297 acres
Arizona Montane Vole	*Microtus montanus arizonensis*	Mesic meadows	PPF, MCD, MCW, Riparian	1,180,795 acres with unknown number of mesic meadows 5,808 acres Montane conifer/willow group 918 springs/seeps 2,718 acres of non-riverine wetlands
Arizona Gray Squirrel	*Sciurus arizonensis arizonensis*	Mid-elevation riparian areas	Riparian	31,252 acres Cottonwood/sycamore group 5,808 acres Montane conifer/willow group 1,655 acres Walnut/evergreen tree group 918 springs/seeps 2,718 acres of non-riverine wetlands

Environmental Consequences for Regional Forester's Sensitive Species

Effects of probable management activities that could potentially affect sensitive species can be grouped into three broad categories: (1) changes in the type, quantity, quality, and spatial arrangement of suitable habitat; (2) direct mortality, reduced survival, or increased susceptibility to mortality; and, (3) increased disturbance.

The Forest Service Manual (FSM 2670) requires an analysis of effects to the species and on any habitat deemed essential. Table 39 lists the special habitat features deemed essential to each species, and the corresponding ERU in which that habitat occurs for the species. Since the goal of restoration is to try to improve the departure rating of each ERU toward desired conditions, this should translate into an improvement of the special habitat features required by each sensitive species. This analysis will focus on the changes in ERU departure ratings as well as the potential short-term effects of the type and amounts treatments by each alternative.

Ecological Conditions

ERU Departure

Species presence and absence in the forest is, in many cases, directly tied to availability, current ecological condition, and key ecosystem characteristics of ERUs (see Terrestrial Habitat at beginning of Wildlife and Botanical Species section). Desired conditions of each ERU were developed as a way to identify what management was needed to improve conditions by vegetation community to try and create more resilient ecosystems that were closer to reference conditions. By default, this should improve habitat conditions for wildlife species, bringing them closer to conditions in which they evolved thus improving viability in the plan area. Table 40 shows the results of the 10-year modelling time frame conducted based on objectives identified for restoration for each ERU for each alternative as well as the number of acres that should either move toward or away from desired conditions based on that modelling.

Table 40. ERU departure percentages and acreage changes by alternative

ERU	Acres	Current Departure	Alternative 1	Alternative 1 Acres	Alternative 2	Alternative 2 Acres	Alternative 3	Alternative 3 Acres	Alternative 4	Alternative 4 Acres	Alternative 5	Alternative 5 Acres
	Total	***%***	***%***	***Change***	***%***	***Change***	***%***	***Change***	***%***	***Change***	***%***	***Change***
CPGB (G)	111,223	65	61	4,449	60	5,561	61	4,449	61	4,449	56	10,010
MSG (G)	121,383	64	62	2,428	56	9,711	62	2,428	62	2,428	54	12,183
SDG (G)	26,184	94	95	-262	89	1,309	95	-262		N/A	88	1,571
JUG (W)	54,701	29	24	2,735	23	3,282	21	4,376	24	2,735	28	547
PJC (W)	59,296	50	54	-2,372	49	593	56	-3,558	55	-2,965	46	2,372
PJG (W)	302,709	39	43	-12,108	35	12,108	40	-3,027	44	-15,135	28	33,298
PJO (W)	848,440	36	28	67,875	33	25,453	27	76,360	28	67,875	41	-42,422
PPE (F)	397,211	43	40	11,916	30	51,637	42	3,972	41	7,944	28	59,582
PPF (F)	683,317	79	78	6,833	75	27,333	78	6,833	77	13,666	74	34,166
MCD (F)	396,244	55	56	-3,962	52	11,887	56	-3,962	55	0	52	11,887
MCW(F)	101,234	40	30	10,123	35	5,062	30	10,123	30	10,123	35	5,062
SFF (F)	23,779	46	43	713	43	713	43	713	43	713	45	238

A minus sign (-) indicates the ERU moved away from desired conditions.

In parentheses, the letter indicates if the ERU is grassland (G), woodland (W), or forested (F).

ERU Departure – Alternative 1

Based on the average number of acres treated within each of the ERUs over the past 10 years, modelling shows that the continuation of activities under alternative 1 would continue to improve desired conditions for the majority of ERUs in the plan area. There are 4 ERUs (SDG, PJC, PJG, and MCD) that would move slightly away from desired conditions over the expected 10- to 15-year life of the plan. None of the sensitive species in the Gila NF uses a single ERU for its life functions. Often the species have habitat requirements that occur within several different ERUs with similar ecological characteristics. For example, Greene's milkweed occurs in grasslands with sandy to rocky soils between 5,000 and 7,000 feet elevation. This can occur within all 3 grassland ERUs. Therefore, while the amount of habitat in SDG (262 acres) shows that it would be moving away from desired condition, there was an overall increase in the amount of habitat moving closer to desired conditions within the grasslands of 6,615 acres (4,449 in CPGB, and 2,428 in MSG). This also does not mean habitat within those 262 acres is no longer usable by species, it only means that some characteristic(s) may have moved away from desired conditions and may be less resilient and more susceptible to uncharacteristic disturbances. The same holds true for the other ERUs that show a change in acres moving away from desired conditions. Overall, the woodland ERUs have an increased amount of habitat (56,130 acres) that would move toward desired conditions, as would the forested ERUs (25,623 acres). Desired conditions, as well as other plan components, for all the vegetative ERUs were designed to move ecological conditions toward reference conditions. Conditions may move away from desired conditions simply because not enough restoration work is accomplished within certain ERUs over the time frame identified or certain attributes of the ERU could be more abundant than reference conditions, such as too many snags or too much downed woody debris (see Vegetation section). While this could be beneficial to species that require those ecological components, it may reduce resiliency of those ERUs with regard to wildland fire.

Determination: The habitat departure from reference conditions is expected to improve overall within each ERU group (grassland, woodland, and forested), and in turn the overall quantity and/or quality of these habitat communities is expected to increase for this alternative. Viability of habitat for species that utilize these vegetative ERUs would be maintained through the plan components within the Vegetation sections as well as species-specific plan components detailed throughout the Threatened and Endangered, and SCC sections earlier in this document.

ERU Departure – Alternatives 2 and 5

Modelling shows that the activities proposed under alternatives 2 and 5 would move closer to desired conditions for all but one ERU (PJO) in alternative 5, within the plan area. This is because the amount of treatment with naturally ignited wildfire in alternative 5, although PJO is not targeted by objectives, would likely create more openings and early seral forested conditions than typically occurred that it would move this ERU away from reference conditions (see upland vegetation, fire ecology and fuels). None of the sensitive species in the Gila NF use a single ERU for its life functions. Often the species have habitat requirements that occur within several different ERUs with similar ecological characteristics. Alternative 2 should improve ecological conditions for all ERUs and move them closer to desired conditions for all sensitive species. Alternative 5 ecological conditions for all ERUs would move closer to desired conditions except for PJO which not only would move away from desired conditions, but there would likely be an overall reduction of late seral, closed canopy ecological conditions overall for the woodland ERUs of approximately 6,205 acres. This represents a reduction of closed-canopy conditions in woodland ERUs of approximately 3.4 percent and in PJO specifically of approximately 5.0 percent over the next 10- to 15-year expected life of the plan. This does not mean habitat within those 6,205 acres is no longer usable by any species, it only means that some characteristic(s) may have moved away from desired conditions. There are species that would likely benefit from the abundance of openings in an otherwise closed canopy vegetation community. Desired conditions, as well as other plan components, for all the vegetative ERUs were designed to move ecological conditions toward reference conditions, and all but one ERU are modelled to move toward desired conditions.

Determination: In alternative 2, the ecological departure from reference conditions is expected to improve within each ERU, and in turn the quantity and quality of these habitat communities is expected to increase for this alternative. Alternative 5 shows an improvement in ecological conditions for all ERUs except for PJO, which would move away from desired conditions for late seral, closed canopy states. This departure of 3.4 percent and 5.0 percent in woodland ERUs and PJO, respectively, could affect species habitat that require these ecological conditions across the landscape. This is not likely to substantially affect the viability of habitat over the life of the plan. Viability of habitat for species that utilize these vegetative ERUs would likely be maintained for both alternatives through the plan components within the Vegetation sections as well as species-specific plan components detailed throughout the Threatened and Endangered, and SCC sections earlier in this document.

ERU Departure – Alternative 3

Modelling shows that activities under alternative 3 would continue to improve desired conditions for the majority of ERUs in the plan area. Four ERUs (SDG, PJC, PJG, and MCD) would move slightly away from desired conditions over the expected 10- to 15-year life of the plan. This alternative would prioritize the restoration of grassland and open woodland ERUs, so these results seem counterintuitive. However, because there are no objectives for using naturally ignited wildfire, the use of prescribed fire is limited and restoration utilizing mostly mechanical treatment is preferred, this would tend to reduce the amount of acres restored because of the much higher cost associated with mechanical treatments vs. fire. Overall, the woodland ERUs have an increased amount of habitat (74,151 acres) that would move toward desired conditions as would the forested ERUs (17,679 acres). Desired conditions, as well as other plan components, for all the vegetative ERUs were designed to move ecological conditions toward reference conditions. Conditions may move away from desired conditions simply because not enough restoration work is accomplished within certain ERUs over the time frame identified or certain attributes of the ERU could be more abundant than reference conditions, such as too many snags or too much downed woody debris (see Vegetation section). While this could be beneficial to species that require those ecological components, it may reduce resiliency of those ERUs with regard to wildland fire.

Determination: The habitat departure from reference conditions is expected to improve overall within each ERU group (grassland, woodland, and forested), and in turn the overall quantity and/or quality of these habitat communities is expected to increase for this alternative. Viability of habitat for species that utilize these vegetative ERUs would be maintained through the plan components within the Vegetation sections as well as species-specific plan components detailed throughout the Threatened and Endangered, and SCC sections earlier in this document.

ERU Departure – Alternative 4

Modelling shows that activities under alternative 4 would continue to improve desired conditions for the majority of ERUs in the plan area. Two ERUs (PJC and PJG) would move slightly away from desired conditions over the expected 10- to 15-year life of the plan. This would be somewhat expected as this alternative would prioritize restoring forested vegetation that could also produce forest products, which contributes to local and regional economic sustainability. None of the sensitive species in the Gila NF uses a single ERU for its life functions. Often the species have habitat requirements that occur within several different ERUs with similar ecological characteristics.

Alternative 4 should improve ecological conditions and move them closer to desired conditions for all ERUs except for PJC and PJG, which would move slightly away from desired conditions. Overall, the woodland ERUs would likely have an increased amount of habitat (52,510 acres) that would move toward desired conditions. Desired conditions, as well as other plan components, for all the vegetative ERUs were designed to move ecological conditions toward reference conditions. Conditions may move away from desired conditions simply because not enough restoration work is accomplished within certain ERUs over the time frame identified or certain attributes of the ERU could be more abundant than reference conditions, such as too many snags or too much downed woody debris (see Vegetation section). While this could be beneficial to species that require those ecological components, it may reduce resiliency of those ERUs with regard to wildland fire.

Determination: The habitat departure from reference conditions is expected to improve overall within each ERU group (grassland, woodland, and forested), and in turn the overall quantity and/or quality of these habitat communities is expected to increase for this alternative. Viability of habitat for species that utilize these vegetative ERUs would be maintained through the plan components within the Vegetation sections as well as species-specific plan components detailed throughout the Threatened and Endangered, and SCC sections earlier in this document.

Cliff, Caves, Mines, Rocky Features Departure and Species Effects – All Alternatives

For species using Cliff, Caves, Mines, and Rocky Features, the primary threats are ground-disturbing activities such as mining, road construction or maintenance, and recreational activities (e.g., rock climbing) as well as climate change. Some species may be mapped as occurring within certain ERUs, but they only use the rocky features within those ERUs and may not be influenced by the vegetation communities. Species in these areas could also be impacted by activities that may occur within the ERUs where the features are located. Therefore, moving the ERUs toward desired conditions along with plan components developed specifically for these features will likely provide benefits to the species that occupy these sites and provide conditions for their persistence. Ecological conditions of cliffs, caves, and talus slopes has not and likely will not change substantially over time and geologic forces act on them over long time periods. There are plan components common to all alternatives that were developed to maintain ecological conditions of these areas as well as minimize any disturbance from management activities that may take place.

Desired conditions for Cliffs and Rocky Features (DC 1)[aa] as well as guidelines (GL 1 and 6), Caves and Abandoned Mine Lands (all plan components), Minerals (Locatable Minerals DC 1; GL 10), Salable/Mineral Materials (DC 2 and 3; STD 1; GL 7-9), and Wildlife, Fish, and Plants (DC 6) would all promote ecological conditions to support sensitive plant and animal species, as well as minimize impacts to sensitive species that use these habitat features. They will also help ensure mining activities will be compatible with ecosystem health and wildlife ecological condition needs, especially bats, providing protection from damage, disturbance and alteration. Plan components were also developed to mitigate disturbance from recreational rock climbing, provide protections from trampling of plants, protection to other species during the breeding season and at maternity roosts, and to minimize the spread of disease for at-risk species (Cliffs and Rocky Features GL 2-5; Caves and Abandoned Mine Lands DC 3, STD 2, GL 1-5; Locatable Minerals GL 10; and Salable/Mineral Materials DC 2 and 3, STD 1, and GL 9; Dispersed Recreation GL 3).

Determination: Viability for species that utilize caves, mines, rocky features, and cliff habitat would be maintained through the Cliffs and Rocky Features, Caves and Abandoned Mine Lands, Minerals,

[aa] DC=Desired Condition; OB=Objective; STD=Standard; GL=Guideline

Dispersed Recreation, and Wildlife Fish and Plants sections. The habitat departure from reference conditions is not expected to change, in turn the quantity and quality of these habitat communities is not expected to change under any action alternative. While individual plants or animals utilizing these areas could be impacted by the actions under all alternatives, these alternatives would not trend sensitive species toward Federal listing.

Species Effects for Regional Forester's Sensitive Species - All Alternatives

All five alternatives would use mechanical vegetation treatment and wildfire to varying degrees to manage all upland ERUs, and mechanical vegetation treatment or structural improvement to manage riparian/water resources (e.g., aquatics, riparian ERUs) to improve ecological condition, abundance, and distribution for species that depend on those vegetation communities. Depending on the alternative, the acreage difference varies as well as the ERUs in which the activities would take place. These systems have varying departure ratings (low to high) from reference conditions. Any of these activities has the potential to modify habitat and create a disturbance for sensitive species, but all activities in the alternatives are intended to move ecological conditions closer to desired conditions. This would improve the ecological conditions for sensitive species increasing resilience of ERUs to uncharacteristic disturbances and improving the likelihood of long-term persistence. All action alternatives include plan direction designed to maintain the diversity of plant and animal communities and support persistence of native species within the plan area, subject to Forest Service authority and the inherent capability of the plan area. Current science demonstrates the positive benefits that forest fuel-reduction treatments can have in terms of improving resiliency in frequent fire-adapted systems of the west/southwest (Stephens et al. 2012).

The main differences between alternatives 2, 3, 4, and 5 that could impact sensitive species include the amount of acres recommended to Congress for wilderness designation, the amount and role of mechanical treatments and wildland fire as restoration tools, and the amount of riparian/aquatic systems restored. The action alternatives more proactively incorporate this thinking than alternative 1. The action alternatives also make better use of partnerships and collaboration to maintain ecosystem integrity and resilience.

Adaptive management will be essential to effectively manage for climate change and associated impacts from disturbance events and invasive species in changing and uncertain conditions. The action alternatives include a monitoring plan designed to better inform the effects and effectiveness of management and progress toward desired conditions. Alternatives 2 through 5 better recognize and address the negative effects non-native invasive species and disease can have on ecosystem integrity and biological diversity. Direction for invasive species was updated and expanded to recognize the threats to ecosystem resilience from all non-native invasive aquatic and terrestrial plants and animals likely to cause harm to ecosystems. Finally, climate change may push rare and endemic species to the limits of their range and evolutionary capacity. This is expected to be especially significant in the Southwest, an area already affected by long-term drought. The action alternatives recognize and include plan components to help address that threat and to reduce the risk of altering ecological conditions important for sensitive species.

There is no recommended wilderness and both wilderness study areas are not recommended for wilderness designation under alternative 1. Recommended wilderness is proposed under alternatives 2 through 5, and the amount of recommended wilderness varies by alternative as shown in table 41:

Table 41. Amount of recommended wilderness by alternative

Alternative	Acres of Recommended Wilderness
2	110,402
3	130,360
4	72,912
5	745,073

Recommended wilderness could potentially provide beneficial effects to sensitive species through its management for the protection or improvement of wilderness character, which minimizes disturbance to species and provides habitat connectivity. However, the Gila NF would also be more limited in its ability to treat these areas through mechanical cutting or prescribed fire and would rely on wildland fire as its main restoration tool. Limiting the ability to treat these areas may leave these areas vulnerable to large, contiguous extents of high-severity fire and cause these areas to become more departed in the future. More departed ecological conditions in the future may negatively affect sensitive species dependent on this habitat.

Botanical areas are proposed under alternatives 2 and 5, and the acreage amount of proposed botanical areas vary by alternative as shown in table 42.

Table 42. Amount of proposed botanical areas by alternative

Alternative	Mogollon Mountains	Pinos Altos Range	Emory Pass
2	45,029	6,198	16,944
5	98,510	20,930	31,150

Plan components for the proposed botanical areas focus on promoting values of rare and endemic plant populations while providing opportunities for stakeholder engagement and education. No new permanent motorized routes will be constructed within the proposed botanical areas and maintenance on existing routes will minimize ground disturbance outside existing road prism and associated drainage features. Designated camping areas will be delineated in the botanical areas that are located outside of designated wilderness and should include educational, interpretive signage. Additionally, the use of non-selective herbicides or herbicides that may have activity on rare and endemic plant species will not occur in special botanical areas unless it is to control or eradicate noxious weed species, and other integrated pest management efforts have failed or are not likely to be successful. If such herbicide use is necessary, mitigation plans to minimize impacts to rare and endemic species populations will be developed and implemented. The plan components provided for the proposed botanical areas would benefit rare and endemic plants by bringing an awareness to their value, but also to other species that occur within them that could potentially be impacted by human disturbance through roads or dispersed camping, as well as any impacts from herbicide use.

Plan components that support resilient and resistant ecosystems and watersheds, would protect species from the negative effects of climate change and would give wildlife species the best opportunity to adapt to changing conditions. This type of plan language, which is included in the four action alternatives, is not explicitly called out under alternative 1 and should have a more positive effect on all sensitive species. A comprehensive list of plan components that would benefit wildlife species has been put together in a crosswalk list (appendix D), and we direct the reader to this appendix to see specific examples, so they will not all be presented in this section.

There could be some localized impacts to these species, but overall, species would continue to persist. Beneficial impacts includes improvement in the type, quantity, quality, and spatial arrangement of suitable habitat, increased survival, decreased susceptibility to mortality, and decreased disturbance.

The types of activities that could potentially disturb or disrupt any life functions of sensitive species would be the same for all alternatives. Because of this, all effects to species will be analyzed together.

Mechanical treatments of vegetation across the plan area not only varies in amounts, but also in what ERUs are prioritized by alternative. Alternatives 1 and 2 propose mechanical treatments to occur within the majority of ERUs. Alternative 3 prioritizes mechanical treatments in grassland and open woodland ERUs, alternative 4 prioritizes them in forested ERUs, while alternative 5 prioritizes mechanical treatment only within WUI areas. Mechanical treatment methods have the potential to not only impact suitable habitat (discussed above in ERU Departure), but also directly disturb individuals potentially lowering survival rates and increasing susceptibility to mortality. Restoring ERUs closer toward desired conditions could increase the amount of acres treated to try to increase resiliency of ERUs from uncharacteristic disturbances and climate change. Plan components have been developed to address this possibility and minimize impacts to species such as Timber, Forest, and Botanical Products (STD 1 and 7, GL 1 and 6). In addition, recovery objectives for threatened and endangered species would also mitigate any impacts through mechanical treatment.

Wildland fire, including both prescribed and naturally ignited wildfire, would likely occur in the plan area under all alternatives. Differences among the alternatives are quite large in some cases. Alternative 1 would likely continue the amount of fire across the landscape at the current rates. Alternatives 2 and 5 propose using wildland fire at much higher rates that would more closely resemble historic fire rotations. Even with the amount of fire the forest has seen within the plan area, there is potential to see much more during the life of the plan (10 to 15 years) because of changing climate and vegetation characteristics. Plan components have been developed to try and accomplish this without the large-scale, high-severity vegetation and watershed impacts (Wildland Fire and Fuels Management DC 5, STD 6, GL 1 and 2, All Upland ERUs DC 1, 2, and 7).

All action alternatives will maintain riparian management zones in, or trending toward proper functioning condition (or equivalent condition class). No new construction or realignment of roads and motorized routes, recreation sites or other infrastructure should be located within the 100-year floodplain, or within 300 feet of a riparian management zone for alternatives 2 through 4, and 500 feet of a riparian management zone containing perennial streams or native trout populations in alternative 5. Treatments on the landscape in the uplands have the potential to increase sedimentation into riparian and aquatic areas. There is more acreage of treatment in alternatives 2 and 5 than alternative 1, but there are desired conditions, standards, and guidelines (e.g., Timber, Forest, and Botanical Products DC 1, STD 1 and 5, GL 3, 6, and 7) that would minimize these impacts, as well as reduce the potential for undesirable effects from uncharacteristic fire, drought, wind, insect infestations, and disease epidemics.

Set objectives to restore structure and function of at least one riparian project annually, above and beyond any noxious or invasive weed treatments (Riparian and Aquatic Ecosystems OB-1), 20 activities and projects that contribute to the recovery of federally listed species and maintain or enhance upland habitat connectivity over each 10-year period (Wildlife, Fish, and Plants OB-3 and 5), and objectives to restore, enhance, or maintain 100 stream miles (Wildlife, Fish, and Plants OB-4), and reduce non-native fish and other aquatic species within native aquatic populations 4-6 stream reaches, and eradicate non-native fish populations from at least one stream reach containing a natural or constructed barrier in compliance with recovery plans during each 10-year period (Non-native Invasive Species OB-4 and 5, respectively). This also includes Desired Conditions in the Roads resource area (DC5) and guidelines (GL 1, 2, and 4) to close or naturalize roads to reduce impacts to ecological resources (that is, watersheds, wildlife and fish habitat, and soil erosion). These plan components would move riparian ecological condition across the forest closer to a desired state.

In addition, day-to-day management activities such as dispersed recreation, livestock grazing, road maintenance, and fuelwood gathering could all impact sensitive species in some way. There is guidance for rare endemic species, protections for cave-dwelling mammals like bats, and measures that prevent the spread of certain invasive species including wildlife diseases (e.g., white-nose syndrome, chytrid fungus) and predators (e.g., bull frog) (Wildlife, Fish, and Plants GL 6 and 10). These will be handled on a project-by-project basis, however, there are plan components developed to help minimize impacts to sensitive species throughout the plan for all alternatives (Wildlife, Fish and Plants GL 1d).

The activities that could impact sensitive species habitat by changing in the type, quantity, quality, and spatial arrangement of suitable habitat, contribute toward direct mortality, reduced survival, or increased susceptibility to mortality, and increasing disturbance for individuals of a species are all the same among all alternatives. Only the amounts of each type of disturbance would be different. Alternatives 1, 2, and 5 have the potential to impact more habitat and more individuals across the plan area, while alternatives 3 and 4 would impact habitat and individuals within grassland, open woodlands, or forested ERUs, respectively. There are plan components that minimize impacts to species throughout the plan. This in conjunction with improving ecological conditions within ERUs (discussed in section above) would likely maintain or improve sensitive species viability and persistence on the plan area.

Determination: Viability for species that utilize upland and riparian ERUs would be maintained through the plan components identified above as well as those developed for most sections in the forest plan (appendix D). While individual plants or animals utilizing these areas could be impacted by the actions under this alternative, the alternative would not trend sensitive species toward Federal listing.

Migratory Birds and Golden and Bald Eagles

The Gila National Forest Migratory Bird Assessment identified migratory bird species that occur or have the potential to occur in the forest by reviewing information from the Birds of the Gila checklist, New Mexico Partners in Flight, USFWS, and the National Audubon Society. Those migratory birds that occur within Gila NF habitats are analyzed. The Migratory Bird Act prohibits the "taking" and "killing" of migratory birds. "Incidental take" is take that results from an activity, but is not the purpose of that activity. This interpretation was recently reviewed (USDI 2017) and the conclusion was that the statute's prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same apply only to affirmative actions that have as their explicit purpose “the taking or killing of migratory birds, their nests, or their eggs” (e.g., hunting, poaching). The Forest Service MOU with the USFWS identifies specific activities for bird conservation, pursuant to Executive Order 13186 including striving to protect, restore, enhance, and manage habitat of migratory birds, and prevent the further loss or degradation of remaining habitats on NFS lands. This includes identifying management practices that affect populations of high priority migratory bird species on NFS lands. Table 43 identifies these high-priority species considered in this analysis.

Golden eagles are known to occur in the Gila NF, but there have been no nest sites documented on National Forest System lands. Bald eagles are common winter residents in the Gila NF, and there is a documented nest site at Quemado Lake that has been occupied by a resident pair. There are few large bodies of water with adequate prey species for bald eagle in the Gila NF to support many nesting pairs. The agency is required by law to protect eagles in accordance with the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c).

Table 43. New Mexico Partners in Flight high priority migratory bird species by vegetation type

Habitat Type	Species	ERU	Special Habitat Features
Chihuahuan Desert Grassland/Cave/Cliff/Rock	Prairie Falcon	Grassland and woodland ERUs	Cave/Cliff/Rock and Chihuahuan Desert Grassland, up to 5,500 feet elevation
Chihuahuan Desert Grassland	Long-billed Curlew	Grassland ERUs	Prairies and grassy meadows usually near water. Nests on ground with short grass often near a rock or other conspicuous object.
Wet Meadow	Wilson's Phalarope	Riparian	Wet Meadow over 7,500 feet elevation Marshes, flooded meadows, playas. Nests in tall, dense, heterogenous vegetation within 100 meters of wetlands.
Southwestern Riparian Woodland (low to moderate elevation riparian)	Common Black Hawk	Riparian	Mature cottonwood or sycamore gallery riparian
Southwestern Riparian Woodland (low to moderate elevation riparian)	Common Ground Dove	Riparian and Woodland ERUs	Open country with shrubs and bushes. Open sandy areas in forest and savannah.
Southwestern Riparian Woodland (low to moderate elevation riparian)	Elf Owl	Riparian, SDG	Southwestern Riparian Woodland, 4,000 to 7,000 feet elevation Low river bottoms and adjacent uplands, nests in cavity trees.
Southwestern Riparian Woodland (low to moderate elevation riparian)	Gila Woodpecker	Riparian	Lowland scrub and riparian woodlands dominated by mature cottonwoods and/or sycamores along stream courses.
Southwestern Riparian Woodland (low to moderate elevation riparian)	Southwestern Willow Flycatcher	Riparian	Riparian and wetland thickets generally of willow, tamarisk or both with mostly native vegetation.
Southwestern Riparian Woodland (low to moderate elevation riparian)	Bell's Vireo	Riparian and Woodland ERUs	Dense brush, willow thickets, and streamside thickets often near water as well as adjoining woodlands.
Southwestern Riparian Woodland (low to moderate elevation riparian)	Lucy's Warbler	Riparian	Mature closed-canopy riparian bosque, late successional stage woodlands, less than 5,000 feet elevation.

Habitat Type	Species	ERU	Special Habitat Features
Southwestern Riparian Woodland (low to moderate elevation riparian)	Summer Tanager	Riparian	Southwestern Riparian Woodland, 4,000 to 7,000 feet elevation Riparian woodlands dominated by tall cottonwood, willow, and sycamore where they occur.
Southwestern Riparian Woodland (low to moderate elevation riparian)	Abert's Towhee	Riparian	Woodlands and thickets along rivers and streams with brushy understory of cottonwood-willow gallery forests.
High Elevation (Montane) Riparian Woodland/Cave/Cliff/Rock	Black Swift	Riparian	Cave/Cliff/Rock and High Elevation Riparian Woodland, over 7,500 feet elevation Canyon cliffs and walls that are cool and shaded from the sun.
High Elevation (Montane) Riparian Woodland	Red-naped Sapsucker	Riparian, MCW	High Elevation Riparian Woodland, Over7,500 feet elevation Mature deciduous forests, particularly aspen.
High Elevation (Montane) Riparian Woodland	Hammond's Flycatcher	Riparian, MCW, SFF	High Elevation Riparian Woodland, Over 7,500 feet elevation Mature stands of primarily mixed-conifer and spruce-fir forest, often close to water with limited understory.
High Elevation (Montane) Riparian Woodland	American Dipper	Riparian	High Elevation Riparian Woodland, Over 7,500 feet elevation Fast moving, clear, rocky streams with numerous rapids, riffles, and waterfalls.
High Elevation (Montane) Riparian Woodland	MacGillivray's Warbler	Riparian	Montane Shrub and High Elevation Riparian Woodland, Over 7,500 feet elevation Riparian habitats and wet thickets with dense undergrowth and moderate cover. Shrub component critical. Ground, low shrub nester.
High Elevation (Montane) Riparian Woodland	Painted Redstart	Riparian	Montane Shrub and High Elevation Riparian Woodland, Over 7,500 feet elevation Dense thickets and oaks in riparian woodland. Ground nester.
Chihuahuan Desert Shrub	Crissal Thrasher	SDG	Chihuahuan Desert Shrub, Less than 5,000 feet elevation Shrubby habitat, especially mesquite.
Chihuahuan Desert Shrub	Scott's Oriole	SDG	Chihuahuan Desert Shrub, less than 5,000 feet elevation Chihuahuan desert with high yucca component.

Habitat Type	Species	ERU	Special Habitat Features
Montane Shrub	MacGillivray's Warbler	Riparian, Woodland ERUs, PPE, PPF	Dense shrubby areas like coniferous forest undergrowth and edge, brushy hillsides, and riparian thickets.
Montane Shrub	Green-tailed Towhee	Woodland and forested ERUs	Dense, diverse shrub habitat at high and low elevations. Nests in low shrubs.
Montane Shrub	Black-chinned Sparrow	Grassland and woodland ERUs	Arid shrublands on rugged, often south slopes, with moderately dense shrubs. Nests in low, dense shrubs.
Piñon – Juniper Woodland	Ferruginous Hawk	Woodland and grassland ERUs	Open grasslands or agricultural fields. Nests preference is forest edge or mature, flat-topped junipers.
Piñon – Juniper Woodland	Gray Flycatcher	Woodland ERUs, MPO, PPE, PPF	Open piñon-juniper with interspersed ponderosa pine. Shrub cover not too dense.
Piñon – Juniper Woodland	Gray Vireo	Woodland ERUs	Rocky hills covered with sparse bushes in scrub in mature juniper generally ranging from 12 to 25 feet in height.
Piñon – Juniper Woodland	Black-throated Gray Warbler	Woodland ERUs	Prefers large stands of piñon-dominated woodland. Often found in dense forests with a canopy, but likes edge habitat.
Ponderosa Pine	Northern goshawk	PPE, PPF, MCD, MCW	Typically nests in mature or old-growth forests with high canopy closure and sparse groundcover. Occasionally nests in more open stands.
Ponderosa Pine	Mexican spotted owl	PPF, MCD, MCW, SFF	Mature or old-growth stands with complex structure, typically uneven aged and multistoried with high canopy cover.
Ponderosa Pine	Flammulated owl	PPE, PPF, MCD, MCW	Open ponderosa pine forest often associated with aspen, large shrub oaks, and clearings. Secondary cavity nester.
Ponderosa Pine	Greater pewee	PPE, PPF, MCD, MCW	Tall conifer forests with clearings. Snags or large trees rising above canopy.
Ponderosa Pine	Olive warbler	Riparian, PPE, PPF, MCD, MCW	Open ponderosa pine/Douglas-fir forests often with an oak understory.
Ponderosa Pine	Virginia's warbler	PJO, PPE, PPF, MCD	Open ponderosa pine forest with well-developed herbaceous or woody understory. Nests on ground or low shrubs.
Ponderosa Pine	Grace's Warbler	PJO, PPE, PPF, MCD	Mature ponderosa pine forest sometimes with a scrub oak component.

Habitat Type	Species	ERU	Special Habitat Features
Mixed Conifer	Northern Goshawk	PPE, PPF, MCD, MCW	Typically nests in mature or old-growth forests with high canopy closure and sparse groundcover. Occasionally nests in more open stands.
Mixed Conifer	Mexican Spotted Owl	PPF, MCD, MCW, SFF	Mature or old-growth stands with complex structure, typically uneven aged and multistoried with high canopy cover.
Mixed Conifer	Williamson's Sapsucker	PPE, PPF, MCD, MCW, SFF	Mid- to high-elevation coniferous forests intermixed with aspen. Aspen important nesting substrate.
Mixed Conifer	Olive-sided Flycatcher	PPE, PPF, MCD, MCW, SFF	Subalpine forest with spruce, Douglas-fir, and aspen and lots of edge habitat. Snags and trees above canopy is important.
Mixed Conifer	Dusky Flycatcher	PPE, PPF, MCD, MCW, SFF	Mixed conifer forest with a shrubby understory critical. Nests in low shrubs.
Mixed Conifer	Red-faced Warbler	PPE, PPF, MCD, MCW, SFF	Fir and pine forests with an oak or deciduous understory. Ground nester in moist forested areas.
Spruce-Fir	Blue Grouse	MCW, SFF	Mostly open areas with deciduous trees and shrubs.
Cliff/Cave/Rock	Peregrine Falcon	All ERUs on forest	Cliffs, ledges or rocky outcrops.
	Bald Eagle	Riparian	Streams, lakes or other aquatic areas
	Golden Eagle	All ERUs on forest	Snags and cliffs near open habitats.

Environmental Consequences for Migratory Birds and Golden and Bald Eagles Common to All Alternatives

Probable management activities that could potentially affect wildlife communities can be grouped into three broad categories: (1) changes in the type, quantity, quality, and spatial arrangement of suitable habitat; (2) direct mortality, reduced survival, or increased susceptibility to mortality; and, (3) increased disturbance.

There would be no programmatic take under the Bald and Golden Eagle Protection Act. Golden eagle nest on cliffs and snags near open areas, but have not been documented nesting within the Gila NF. Cliffs and rock features are widespread microsites within all vegetation communities within the plan area. These ecological conditions are inherently stable for long periods of time because they are changed primarily by geologic forces. Bald eagle use in the forest is mostly for foraging and migration/winter use although there has been a pair documented nesting near Quemado Lake. The plan revision process addressed the needs of migratory birds and eagles by considering the habitat upon which these birds depend during the development of plan components for the action alternatives. Such considerations are already in place under alternative 1. Migratory birds are ubiquitous and use numerous habitat types across a range of elevations. Restoration of many vegetation types at various elevations would benefit habitat for migratory bird species, especially in cases where restoration focuses on moving the vegetation toward desired conditions which would improve resilience to wildfire and changing climate conditions, protect and restore riparian and watershed conditions, and control or eradicate invasive species.

Under all alternatives, important bird areas would not be impacted by management activities. These IBAs include the Emory Pass, Mimbres River, Cliff-Gila Valley, and Gila Bird Area. The Gila Bird Area is the only important bird area that identifies any conservation issues associated with the area. There is an upstream invasion of exotic yellow starthistle that may become problematic, although it is still very rare here. Because of channel incision upstream, there were some problems with bank erosion that the Gila NF has stabilized using bio-techniques. The Gila Bird Area is immediately adjacent to the Gila River RNA that has plan components that will minimize impacts to ecological values (Research Natural Areas STD 3, GL 3) and the Emory Pass IBA is located in an area that is rugged and typically only sees hikers and other dispersed uses.

Ecological Condition

ERU Departure

Table 43 above lists the special habitat features for each species, and the corresponding ERU in which that habitat occurs for the species. Since the goal of restoration is to try to improve the departure rating of each ERU toward desired conditions, this should translate into an improvement of the special habitat features required by each migratory bird species. Similar to the analysis for sensitive species, this analysis will focus on the changes in ERU departure ratings as well as the potential short-term effects of the type and amounts treatments by each alternative.

Species presence and absence in the forest is, in many cases, directly tied to availability, current ecological condition, and key ecosystem characteristics of ERUs (see Terrestrial Habitat at beginning of Wildlife and Botanical Species section). Desired conditions of each ERU was developed as a way to identify what management was needed to improve conditions by vegetation community to try and create more resilient ecosystems that were closer to reference conditions. By default, this should improve habitat conditions for wildlife species, bringing them closer to conditions in which they evolved thus improving viability in the plan area. Table 40 (sensitive species section above) shows the results of the 10-year modelling time frame conducted based on objectives identified for restoration for each ERU as well as the number of acres that should either move toward or away from desired conditions based on that modelling.

ERU Departure – Alternative 1

Based on the average number of acres treated within each of the ERUs over the past 10 years, modelling shows that the continuation of activities under alternative 1 would continue to improve desired conditions for the majority of ERUs in the plan area. Four ERUs (SDG, PJC, PJG, and MCD) would move slightly away from desired conditions over the expected 10- to 15-year life of the plan. None of the migratory bird species in the Gila NF uses a single ERU for its life functions. Often the species have habitat requirements that occur within several different ERUs with similar ecological characteristics. For example, long-billed curlew occurs in grasslands that contain prairies and grassy meadows usually near water. They nests on ground with short grass often near a rock or other conspicuous object. These conditions can occur within all three grassland ERUs. Therefore, while the amount of habitat in SDG (262 acres) shows that it would be moving away from desired condition, there was an overall increase in the amount of habitat moving closer to desired conditions within the grasslands of 6,615 acres (4,449 in CPGB, and 2,428 in MSG). This also does not mean habitat within those 262 acres is no longer usable by species, it only means that some characteristic(s) may have moved away from desired conditions and may be less resilient and more susceptible to uncharacteristic disturbances. The same holds true for the other ERUs that show a change in acres moving away from desired conditions. Overall, the woodland ERUs have an increased amount of habitat (56,130 acres) that would move toward desired conditions, as would the forested ERUs (25,623 acres). Desired conditions, as well as other plan components, for all the vegetative ERUs were designed to move ecological conditions toward reference conditions. Conditions may move away from desired conditions simply because not enough restoration work is accomplished within certain ERUs over the time frame identified or certain attributes of the ERU could be more abundant than reference conditions, such as too many snags or too much downed woody debris (see Vegetation section). While this could be beneficial to species that require those ecological components, it may reduce resiliency of those ERUs with regard to wildland fire.

Determination: The habitat departure from reference conditions is expected to improve overall within each ERU group (grassland, woodland, and forested), and in turn the overall quantity and/or quality of these habitat communities is expected to increase for this alternative. Viability of habitat for species that utilize these vegetative ERUs would be maintained or enhanced through the plan components within the Vegetation sections as well as species-specific plan components detailed throughout the Threatened and Endangered, and SCC sections earlier in this document. No significant effects will occur to migratory birds because this alternative will not substantially alter existing habitat for migratory bird species of concern. The burning and mechanical treatment of upland vegetation has the potential to impact some migratory birds, but these activities have actually been shown to be beneficial to some species of birds. There will likely be some disturbance to some species associated with management activities as a result of this alternative. Disturbances to or loss of birds or nests due to management activities, such as through burning, trampling or otherwise dislodging of a nest, or from other activities resulting in unintentional take are expected to be infrequent and will not rise to a level that affects the total population size for any species.

ERU Departure – Alternatives 2 and 5

Modelling shows that the activities proposed under alternatives 2 and 5 would move closer to desired conditions for all but one ERU (PJO) in alternative 5, within the plan area. This is because the amount of treatment with naturally ignited wildfire in alternative 5, although PJO is not targeted by objectives, would likely create more openings and early seral forested conditions than typically occurred that it would move this ERU away from reference conditions (see Upland Vegetation and Fire and Fuels Management sections). None of the migratory bird species in the Gila NF use a single ERU for its life functions. Often the species have habitat requirements that occur within several different ERUs with similar ecological characteristics. Alternative 2 should improve ecological conditions for all ERUs and move them closer to desired conditions for all species. Alternative 5 ecological conditions for all ERUs would move closer to desired conditions except for PJO which not only would move away from desired conditions, but there would likely be an overall reduction of late seral, closed canopy ecological conditions overall for the woodland ERUs of approximately 6,205 acres. This represents a reduction of closed-canopy conditions in woodland ERUs of approximately 3.4 percent and in PJO specifically of approximately 5.0 percent over the next 10- to 15-year expected life of the plan. This does not mean habitat within those 6,205 acres is no longer usable by any species, it only means that some characteristic(s) may have moved away from desired conditions. There are species that would likely benefit from the abundance of openings in an otherwise closed canopy vegetation community. Desired conditions, as well as other plan components, for all the vegetative ERUs were designed to move ecological conditions toward reference conditions, and all but one ERU are modelled to move toward desired conditions.

Determination: In alternative 2, the ecological departure from reference conditions is expected to improve within each ERU, and in turn the quantity and quality of these habitat communities is expected to increase for this alternative. Alternative 5 shows improved ecological conditions for all ERUs except for PJO, which would move away from desired conditions for late seral, closed canopy states. This departure of 3.4 percent and 5.0 percent in woodland ERUs and PJO, respectively, could impact species habitat that require these ecological conditions across the landscape. This is not likely to substantially affect the viability of habitat over the life of the plan. Viability of habitat for species that utilize these vegetative ERUs would likely be maintained for both alternatives through the plan components within the Vegetation sections as well as species-specific plan components detailed throughout the Threatened and Endangered, and SCC sections earlier in this document. No significant effects will occur to Migratory Birds because these alternatives will not substantially alter existing habitat for migratory bird species of concern. The burning and mechanical treatment of upland vegetation has the potential to affect some Migratory Birds, but these activities have actually been shown to be beneficial to some species of birds. There will likely be some disturbance to some species associated with management activities as a result of these alternatives. Disturbances to or loss of birds or nests due to management activities, such as through burning, trampling or otherwise dislodging of a nest, or from other activities resulting in unintentional take are expected to be infrequent and will not rise to a level that affects the total population size for any species.

ERU Departure – Alternative 3

Modelling shows that activities under alternative 3 would continue to improve desired conditions for the majority of ERUs in the plan area. Four ERUs (SDG, PJC, PJG, and MCD) would move slightly away from desired conditions over the expected 10- to 15-year life of the plan. This alternative would prioritize the restoration of grassland and open woodland ERUs, so these results seem counterintuitive. However, because there are no objectives for using naturally ignited wildfire, the use of prescribed fire is limited and restoration utilizing mostly mechanical treatment is preferred, this would tend to reduce the amount of acres restored because of the much higher cost associated with mechanical treatments versus fire. Overall, the woodland ERUs have an increase in the amount of habitat (74,151 acres) that would move toward desired conditions as would the forested ERUs (17,679 acres). Desired conditions, as well as other plan components, for all the vegetative ERUs were designed to move ecological conditions toward reference conditions. Conditions may move away from desired conditions simply because not enough restoration work is accomplished within certain ERUs over the time frame identified or certain attributes of the ERU could be more abundant than reference conditions, such as too many snags or too much downed woody debris (see Vegetation section). While this could be beneficial to species that require those ecological components, it may reduce resiliency of those ERUs with regard to wildland fire.

Determination: The habitat departure from reference conditions is expected to improve overall within each ERU group (grassland, woodland, and forested), and in turn the overall quantity and/or quality of these habitat communities is expected to increase for this alternative. Viability of habitat for species that utilize these vegetative ERUs would be maintained through the plan components within the Vegetation sections as well as species-specific plan components detailed throughout the Threatened and Endangered, and SCC sections earlier in this document. No significant effects will occur to migratory birds because this alternative will not substantially alter existing habitat for migratory bird species of concern. The burning and mechanical treatment of upland vegetation has the potential to impact some migratory birds, but these activities have actually been shown to be beneficial to some species of birds. There will likely be some disturbance to some species associated with management activities as a result of this alternative. Disturbances to or loss of birds or nests due to management activities, such as through burning, trampling or otherwise dislodging of a nest, or from other activities resulting in unintentional take are expected to be infrequent and will not rise to a level that affects the total population size for any species.

ERU Departure – Alternative 4

Modelling shows that activities under alternative 4 would continue to improve desired conditions for the majority of ERUs in the plan area. Two ERUs (PJC and PJG) would move slightly away from desired conditions over the expected 10- to 15-year life of the plan. This would be somewhat expected, as this alternative would prioritize restoring forested vegetation that could also produce forest products, which contributes to local and regional economic sustainability. None of the migratory bird species in the Gila NF use a single ERU for its life functions. Often the species have habitat requirements that occur within several different ERUs with similar ecological characteristics. Alternative 4 should improve ecological conditions and move them closer to desired conditions for all ERUs except for PJC and PJG, which would move slightly away from desired conditions. Overall, the woodland ERUs would likely have an increased amount of habitat (52,510 acres) that would move toward desired conditions. Desired conditions, as well as other plan components, for all the vegetative ERUs were designed to move ecological conditions toward reference conditions. Conditions may move away from desired conditions simply because not enough restoration work is accomplished within certain ERUs over the time frame identified or certain attributes of the ERU could be more abundant than reference conditions, such as too many snags or too much downed woody debris (see Vegetation section). While this could be beneficial to species that require those ecological components, it may reduce resiliency of those ERUs with regard to wildland fire.

Determination: The habitat departure from reference conditions is expected to improve overall within each ERU group (grassland, woodland, and forested), and in turn the overall quantity and/or quality of these habitat communities is expected to increase for this alternative. Viability of habitat for species that utilize these vegetative ERUs would be maintained through the plan components within the Vegetation sections as well as species-specific plan components detailed throughout the Threatened and Endangered, and SCC sections earlier in this document. No significant effects will occur to migratory birds because this alternative will not substantially alter existing habitat for migratory bird species of concern. The burning and mechanical treatment of upland vegetation has the potential to affect some migratory birds, but these activities have actually been shown to be beneficial to some species of birds. There will likely be some disturbance to some species associated with management activities as a result of this alternative. Disturbances to or loss of birds or nests due to management activities, such as through burning, trampling or otherwise dislodging of a nest, or from other activities resulting in unintentional take are expected to be infrequent and will not rise to a level that affects the total population size for any species.

Cliff, Caves, Mines, Rocky Features Departure and Species Effects – All Alternatives

For species using Cliff, Caves, Mines, and Rocky Features, the primary threats are ground disturbing activities such as mining, road construction or maintenance, and recreational activities (e.g., rock climbing) as well as climate change. Some species may be mapped as occurring within certain ERUs, but they only use the rocky features within those ERUs, and may not be influenced by the vegetation communities. Species in these areas could also be impacted by activities that may occur within the ERUs where the features are located. Therefore, moving the ERUs toward desired conditions along with plan components developed specifically for these features will likely provide benefits to the species that occupy these sites and provide conditions for their persistence. Ecological conditions of cliffs, caves, and talus slopes has not and likely will not changes substantially over time and geologic forces act on them over long time periods. There are plan components common to all alternatives that were developed to maintain ecological conditions of these areas as well as minimize any disturbance from management activities that may take place.

Desired conditions for Cliffs and Rocky Features (DC 1) as well as guidelines (GL 1 and 6), Caves and Abandoned Mine Lands (all plan components), Minerals (Locatable Minerals DC 1; GL 10), Salable/Mineral Materials (DC 2 and 3; STD 1; GL 7-9), and Wildlife, Fish, and Plants (DC 6) would all promote ecological conditions to support native plant and animal species, as well as minimize impacts to species that use these habitat features. They will also help ensure mining activities will be compatible with ecosystem health and wildlife ecological condition needs, providing protection from damage, disturbance and alteration. Plan components were also developed to mitigate disturbance from recreational rock climbing, provide protections from trampling of plants, protection to other species during the breeding season, and to minimize the spread of disease for at-risk species (Cliffs and Rocky Features GL 2-5; Caves and Abandoned Mine Lands DC 3, STD 2, GL 1-5; Locatable Minerals GL 10; and Salable/Mineral Materials DC 2 and 3, STD 1, and GL 9; Dispersed Recreation GL 3).

Determination: Viability for species that utilize caves, mines, rocky features, and cliff habitat would be maintained through the Cliffs and Rocky Features, Caves and Abandoned Mine Lands, Minerals, Dispersed Recreation, and Wildlife Fish and Plants sections. The habitat departure from reference conditions is not expected to change, in turn the quantity and quality of these habitat communities is not expected to change under any action alternative. No significant effects will occur to migratory birds because the action alternatives will not substantially alter existing habitat for migratory bird species of concern. The burning and mechanical treatment of upland vegetation has the potential to affect some migratory birds, but these activities have actually been shown to be beneficial to some species of birds. There will likely be some disturbance to some species associated with management activities as a result of the action alternatives. Disturbances to or loss of birds or nests due to management activities, such as through burning, trampling or otherwise dislodging of a nest, or from other activities resulting in unintentional take are expected to be infrequent and will not rise to a level that affects the total population size for any species.

Cumulative Effects

The analysis area for wildlife, fish, and plants includes private, state, and other Federal lands within and adjacent to the Gila NF. Past actions in the plan area have contributed to the existing baseline, while future actions will be addressed in the specific project-level environmental analysis. Land resource management plans (RMPs) have been completed by the Las Cruces and Socorro Field Offices of the BLM to manage lands adjacent to the Gila NF. These RMPs encompass lands that may be adjacent to the Gila NF in Sierra, Otero, Dona Ana, Grant, Hidalgo, Catron, Luna, and Socorro Counties. In addition, there are a wide range of planning and land use strategies that have been adopted by Catron, Grant, Hidalgo, and Sierra Counties that address land use (including interface with public lands) and suggest ways to foster more communication and collaboration between local governments and Federal land management agencies. Local soil and water conservation districts have also written land use plans to promote responsible and effective use and management of soil and water resources in their districts. The State of New Mexico has also issued a Statewide Natural Resources Assessment and Strategy and Response Plan that guides planning and implementation of natural resource management and restoration activities for the state. It also provides strategies for working with and integrating resources across boundaries with federal, tribal, and private landowners. Implementation of all of these plans in combination with the Gila NF forest plan contribute to the cumulative effects of species that occur within and adjacent to the forest, including species that travel between multiple jurisdictions.

Many of the same activities that occur on National Forest System land are the same activities being conducted on lands adjacent to the forest. Land management activities adjacent to the forest as outlined in the above mentioned plans, include manual and mechanical cutting of vegetation, herbicide use, livestock grazing, recreational activities, prescribed and naturally ignited fire, and road construction and maintenance to name a few. Timber harvest, fire suppression, thinning, and wildfires are the past activities that have had the greatest influence on the amount and distribution of forested habitat on NFS lands as well as BLM, state, and private timberlands. These activities have created a variety of successional stages, structures, tree species mixes, and forest patterns that have been neutral for some wildlife species, beneficial to some wildlife species, and detrimental to others. Timber harvest occurring on private, state, BLM, or NFS lands may cumulatively affect the quantity and quality of wildlife habitat. The effects to wildlife are difficult to predict because they would depend on a wide variety of factors (e.g., whether habitat that is outside of historical conditions is restored, where wildfires and infestations of insects or diseases occur, the type and location of vegetation treatments). If harvesting moves vegetation toward desired conditions for wildlife, the effects would be beneficial. This could result in better retention of very large size class trees. In the WUI, pre-commercial thinning, timber harvest, and prescribed burning would reduce stand densities, would increase survival of retained trees, and could increase the rate at which very large trees develop. On managed lands, active vegetation restoration actions could mimic natural disturbances in areas where natural disturbances are not compatible with multiple-use objectives of the forest plan or the objectives of other landowners. The impacts from these activities could affect connectivity and dispersal of species that are crossing jurisdictional boundaries as well as add to disturbances during critical times such as breeding season. Additionally, activities within the uplands could increase amount of sedimentation into stream courses and affect species that rely on riparian and aquatic areas. The goal of any of these management activities on public lands is to improve conditions of the landscape to provide for a healthy, resilient ecosystem. Overall, the activities should improve ecological conditions of the native wildlife within these ownerships.

Development of lands adjacent and within the forest can alter habitat conditions for species and increase disturbance in areas that may have had little in the past. Activities associated with land development could also impact springs through water developments, sedimentation from road construction, and potential vegetation changes from land clearing for construction or fire protection of structures. Other land ownerships may differ in the amount and type of treatment that is appropriate within ERUs that may occur adjacent to the national forest. Alternative energy development (i.e., wind farms, solar arrays) appear to be increasing in their technological advances as well as popularity, and there are already wind and solar farms adjacent to the Gila NF. These have been known to cause mortality to bird and bat species, which could potentially increase with further developments.

Visitation has increased over the last 10 years, but it is unknown whether this trend will continue. There is a potential of increased disturbance from the increase in visitation. Caving and rock-climbing are popular recreational activities in some areas and may increase in the future, but these activities require specialized training and/or equipment and they are not likely to increase as rapidly as other types of recreation. Recreational cave and mine exploration on all land ownerships can lead to an increased rate of the spread of diseases such as white-nose syndrome. There is a decontamination protocol in place for cavers on NFS lands, which should aid in slowing the spread on NFS lands, but diseases may continue to be spread elsewhere. Because both people and bats may carry diseases and travel long distances, disease can be spread across a wide area. Disease control requires a cooperative effort. Multiple agencies are monitoring bats, which will help support adaptive management and response to outbreaks.

Introduction of aquatic invasive species or contaminants in waterbodies resulting from recreational, agricultural, or industrial activities may have negative impacts on species associated with aquatic, wetland, and/or riparian habitats. The potential for introduction of disease and aquatic nuisance species exists on all lands within the cumulative effects analysis area, often as an indirect result of water-based recreation. Many management agencies have increased inspections and public education efforts in recent years in order to reduce these risks.

Climate change has occurred to some degree and will continue in the future. It is projected to increase the frequency, severity and duration of droughts (IPCC 2007; Seager et al. 2007). Climate change is likely to modify ecological conditions, processes and ecosystem services in many regions and ecosystems (Westerling et al. 2006; Bowman et al. 2009; Flannigan et al. 2009) including the cumulative effects analysis area, by altering precipitation patterns, and the timing, quantity, duration and distribution of available water. The effects of climate change could be particularly profound for native fishes and aquatic ecosystems of the Rocky Mountains and Arizona-New Mexico Mountains because those systems often lack resilience and are strongly dependent on temperature and stream flow regimes that are already documented to be changing (Rieman and Isaak 2010). In addition, plants in the arid Southwest already live near their physiological limits for water and temperature stress (Archer and Predick 2008).

Ramifications of a changing climate to species are likely to include: reduced snowfall or earlier snow melt in the spring, extended periods of drought or extended dry periods in the spring and summer, more frequent and larger wildfires, increased insect- and disease-induced mortality, and changes in site characteristics that promote type conversion or vegetation community changes. These changes cause seasonal ranges and food sources for wildlife to shift and can affect the timing of reproduction. Reduced snowpack and changes in precipitation can affect aquatic species by decreased stream flow and shifts in runoff patterns that could affect spawning success. Forested tracts and remote habitats for all wildlife can also become isolated, reducing landscape connectivity and ecological condition for species with limited dispersal ability. The timing of spring green-up can also affect food availability for migratory birds or forage conditions for big game. Those species with highly specialized ecological condition requirements, at the edge of their range, currently in decline, and/or having poor dispersal abilities may be particularly at risk (National Fish Wildlife and Plants Climate Adaptation Partnership 2012).

Herbicide-Use Environmental Consequences

The following discussion of environmental consequences addresses the effects of the herbicide-use alternatives on threatened and endangered species, and designated and proposed critical habitat (see table 23 federally listed threatened or endangered species listed for the four-county area (Catron, Grant, Hidalgo, and Sierra) of the Gila National Forest), Species of Conservation Concern (SCC) (see table 26), Forest Service sensitive, and migratory bird and eagle species. Specific effects will be detailed in a Biological Assessment and Evaluation, and consultation with the USFWS will occur when threatened or endangered species may be affected. All terms and conditions, and reasonable and prudent measures from consultation with the USFWS would be integrated into project design where herbicides are part of site-specific projects and activities.

Analysis Methodology

This section discusses impacts to various groups of wildlife and plant species and the potential risks associated with invasive plant treatments proposed in all alternatives. It will use the data from the different Human Health and Ecological Risk Assessments prepared for the Forest Service to date. To ensure the effects analysis remains accurate for herbicides that the Forest Service authorizes in the future, the Gila NF will review and document that these effects remain within the parameters of this analysis prior to their use. It is assumed that all law, regulation, policy, label instructions, Forest Service risk assessment information and plan direction are followed.

Effects Common to All Herbicide-Use Alternatives

All of the alternatives authorize manual removal, as well as the use of some herbicides on some number of noxious weeds. All application methods would be authorized as permitted by the product label except aerial application. Noxious weeds reduce native plant diversity and can alter ecological processes through a variety of mechanisms. Some noxious species release toxins that suppress the growth of native plants or alter nutrient cycling. Others alter fire behavior, intensity, extent and season of burning, potentially leading to accelerated erosion and sedimentation. These strategies lead to long-term alteration of native plant community composition, reduced ecosystem function, and movement away from the desired conditions for vegetation communities is common to all forest plan alternatives.

Potential threats to wildlife from non-native invasive species under all alternatives include effects to foraging activities and habitat, effects to reproduction activities and habitat, effects to cover habitat, and effects to overall species diversity. Generally, non-native invasive plant treatments would not alter native habitat structure or composition for terrestrial wildlife species, but left untreated, non-native plant infestations could alter important habitat components for a number of species. Incidental damage or removal of native vegetation immediately adjacent to non-native invasive plants or within the infested weed site may occur during treatments, but would be very limited in distribution and magnitude. Integrating design criteria into the project design would reduce these effects. However, due to the patchy nature of most non-native invasive plant infestations and the selective nature of some of the herbicides, the amount of cover lost would be very small compared to the amount of habitat available.

Manual removal of noxious and native invasive species could also affect wildlife and plant species and/or their habitat. Hand pulling herbaceous noxious species would cause some ground disturbance and may introduce small amounts of sediment to streams. The presence of people or crews with hand-held tools along streambanks could lead to localized sedimentation and turbidity in fish habitat because of trampling and soil sloughing. However, the amount of sediment generated would be negligible, and turbidity would quickly dissipate. Crews implementing noxious plant removal under any of the alternatives has the potential to displace foraging and reproductive activities by mammals, birds, amphibians, and reptiles. Misidentification of plant species could lead to removal of desired plant species or even species listed as at-risk. All treatments in all alternatives involve the potential for people to disturb nesting, roosting or breeding wildlife.

While herbicide use is generally low risk to both terrestrial and aquatic wildlife, the consequences are high for native plants including many of the species that make up the entirety of upland and riparian ERUs (see Upland Vegetation Herbicide-Use Environmental Consequences). Several native, rare and endemic plant species have been identified within the plan area as well. Special attention and care would need to be taken to minimize or eliminate any non-target impacts to these species under all alternatives (see design criteria for herbicide use above/section). The use of non-selective herbicides or herbicides that may have effects on rare and endemic plant species will not occur in recommended rare and endemic plant management areas unless it is to control or eradicate noxious weed species, and other integrated pest management efforts have failed or are not likely to be successful. If such herbicide use is necessary, mitigation plans to minimize impacts to rare and endemic species populations will be developed and implemented. This should help minimize impacts within those recommended areas that have an increased number of rare or endemic species. There are rare and endemic species that are not located within these areas that could potentially be impacted in the Gila NF.

Impacts to those at-risk wildlife species from human disturbance and herbicide application should be minimal as approved herbicides are generally low risk to those species when used in accordance to label directions and rates. Effects to at-risk plant species from manual removal and herbicide application methods should also be minimal when using either removal method because most noxious weed infestations are patchy and not very widespread in the Gila NF. However, consequences to at-risk plant species as well as native plants that are important habitat components for wildlife could be high from both methods of removal. Misidentification of certain plants could result in at-risk plants being pulled, grubbed, or sprayed, which could result in the death of several individuals of those species, as most herbicides would affect at-risk plant species. Insects could be impacted as well, such as western bumblebee and nitrocris fritillary butterfly (both at-risk species), by removing a variety of flowering plants used by the bumblebee and also streambank violet (*Viola nephrophylla*) that is a host plant for the larvae of the butterfly necessary for persistence of that species. These impacts could be mitigated through ensuring plants are properly identified and/or using herbicide application techniques (spot spray versus broadcast spray) or other design criteria that would minimize treating non-target species or reducing the amount of drift.

Effects of Herbicide-Use Alternative A-No Action

Alternative A allows all noxious weed species on the New Mexico Department of Agriculture's noxious weed list as it existed in 2000, with the addition of tree of heaven, to be manually pulled or cut with a chainsaw and/or treated with herbicide. Fourteen different herbicides are approved for use, and all methods except aerial application are allowable. No new noxious weeds added by NMDA to the noxious weed list after 2000 are authorized for treatment and no native plant species may be targeted. This alternative does not fully support EDRR, which would not facilitate rapid response to emerging threats.

Effects Common to All Herbicide-Use Action Alternatives

Alternatives B, C, and D authorize manual removal and herbicide treatments on all noxious weed species listed on the most current APHIS, NMDA, or other state department of agriculture noxious weed lists. Any noxious plant species added to any of these lists after this NEPA decision would be automatically authorized for treatment. Waiting for state listing and the NEPA process to authorize their treatment could limit EDRR, and therefore, these alternatives are more likely to support a successful EDRR program, preserve native biodiversity and ecosystem function, and promote movement toward and maintenance of desired conditions.

These alternatives also authorize the use of any herbicide with both an EPA and Forest Service risk assessment (Upland Vegetation Herbicide-Use Environmental Consequences). Risk assessments for existing herbicides can be updated when new information is available about an existing herbicide, and as new herbicides are developed and assessed, they would be authorized under these alternatives. This allows management to stay current with the science informing proper herbicide use and eliminates the need for new NEPA analyses to add any herbicides that might be developed and approved for use in the future. It does not contribute to any additional detrimental non-target effects because law, regulation, policy, risk assessments, and plan direction will be followed to ensure proper use. It does have the potential to generate beneficial effects, as new herbicides may be associated with less risk of non-target effects or movement in the environment.

Each herbicide must go through an independent Forest Service risk assessment to determine affects to human health as well as ecological risk. Two types of exposure scenarios are developed for risk assessments; acute exposure and longer-term or chronic exposure. In the Ecological Risk Assessment portion of the Forest Service risk assessments, the analysis specifically looks at both of these exposure scenarios for several groups of species: Terrestrial organisms (mammals, birds, reptiles, amphibians (terrestrial phase), invertebrates, plants, and microorganisms), as well as aquatic organisms (fish, amphibians (aquatic phase), invertebrates, and plants). Terrestrial animals might be exposed to any applied herbicide from direct spray, the ingestion of contaminated media (vegetation, prey species, or water), grooming activities, or indirect contact with contaminated vegetation. Since herbicides are applied to vegetation, the consumption of contaminated vegetation or potential prey species that are exposed to this vegetation is a concern. In addition to consuming contaminated vegetation, exposed insects may reach ambient water and could potentially concentrate the chemicals in fish that feed on these insects, as well as a variety of other possible direct and indirect effects (see Riparian/Aquatic Herbicide-Use Environmental Consequences). For this reason, risk assessments also look at scenarios for the consumption of contaminated fish by predatory birds in both acute and chronic exposures, as well as application to water bodies, and accidental spills. In these risk assessments, risk characterization for systemic toxic effects is expressed as a hazard quotient (SERA 2014b)—where any hazard quotient is 1 or less it indicates that adverse effects are not likely to occur, and thus, is considered to have a negligible hazard. Hazard quotients greater than 1 are not statistical probabilities of harm occurring. Instead, they are a simple statement of whether (and by how much) an exposure concentration exceeds the reference concentration (Chem Safety Pro 2019). The quantitative risk analysis for several of the herbicides revealed that under plausible (typically maximum application rate according to label) application/exposure scenarios the toxicity thresholds for wildlife were not exceeded (SERA 2011a, SERA 2011b, SERA 2011c). Given the type of infestations that would be treated, the product labels, and Forest Service handbook and draft forest plan standards and guidelines, there is low likelihood that wildlife would be exposed to harmful levels of herbicide. In general, there is low risk from the use of herbicides when used at labeled application rates to free-ranging wildlife.

Effects of Herbicide-Use Alternative B-Proposed Action

Alternative B would authorize the use of herbicide to control noxious weeds as well as the density of native alligator juniper and evergreen oak species forest-wide. Alligator juniper and evergreen oak species proliferate by seed and by re-sprouting. Hazardous fuels and restoration treatments open up the forest canopy and create warmer, drier site conditions that favor re-sprouting species and provide the physical space, light and nutrients to stimulate germination and growth from the seedbank. Over the long term, these treatments lead to increase in the abundance and cover of alligator juniper and evergreen oak.

Effects to at-risk wildlife and plant species would be the same as what was previously described above. The only difference with this alternative being the extent of treatment acres would likely increase to incorporate areas where alligator juniper and evergreen oak occur. Draft forest plan alternatives 1, 3, and 4 would likely see the most acres of herbicide use to treat the juniper and oak for restoration, as they would treat more acres mechanically, while treating fewer acres with wildland fire. While wildland fire can also impact at-risk species, many of them have evolved with fire as a natural component of the ecosystems and have adaptations that enable them to thrive. There is also an increased chance for non-target species impacts through the additional acreage treated with manual or herbicide treatments. Draft forest plan alternatives 2 and 5 would likely see the most acres of restoration in the plan area, with much of the treatment in the form of wildland fire for ecosystem restoration. Manual and herbicide treatment of noxious weeds as well as juniper and evergreen oak for restoring ecosystems would also be used. The number of acres of herbicide treatment would be higher than herbicide alternative A, because of the added acreage of juniper and evergreen oak across the landscape, but likely fewer acres than would be used for draft forest plan alternatives 1, 3, and 4, as fire would likely be used more for restoration and maintenance of vegetation. Draft forest plan alternatives 2 and 5 also propose Rare and Endemic Plant Management Areas where herbicide use would be more restrictive, and they have plan components to mitigate any impacts to native and endemic plant species, of which several are at-risk species.

Effects of Herbicide-Use Alternative C

Effects to at-risk species and extent of treatment area would be identical to herbicide alternative A for noxious weeds. However, alternative C has more management options than alternative A because it includes using the current noxious weed lists, EDRR, and EPA and Forest Service risk assessments. This would quickly address any new noxious species infestations or new herbicides that have undergone risk assessments.

Effects of Herbicide-Use Alternative D

The effects specific to alternative D are similar to those of alternative B for all draft forest plan alternatives. However, the use of herbicide to treat native species would be restricted to use only within the WUI, reducing the acreage that could be treated by herbicide substantially as compared to alternative B. Draft forest plan alternatives 2 and 5 propose Rare and Endemic Plant Management Areas where herbicide use would be more restrictive where they overlap the WUI. There are plan components to mitigate any impacts to rare and endemic plant species, of which several are at-risk species.

Determination for all Herbicide-Use Alternatives

While some individuals could be impacted by actions on the forest, the alternative management activities would not adversely affect the viability of the species, and would provide the ecological conditions necessary to maintain viability and persistence in the plan area. Overall, species viability would be maintained for all species. Beneficial impacts include an improvement in native plant composition.

Cumulative Effects

The cumulative effects to wildlife, fish and plants in the forest, as a result of the herbicide use proposals, would be the similar to the draft forest plan cumulative effects. However, because herbicide use limits the spread of noxious plants and allows more acres to be treated, the potential for positive outcomes are greater.

Timber, Forest and Botanical Products

Affected Environment

National Forest System lands were established with the intent of providing goods and services to satisfy public needs over the long term, which includes the production of a sustainable supply of timber, forest and botanical products. Timber products include but are not limited to fuelwood (firewood), sawtimber, pulpwood, non-sawlog materials removed in log form and biomass for electricity. Forest products include but are not limited to Christmas trees, posts, poles and vigas. Botanical non-forest products include but are not limited to piñon nuts, bark, berries, boughs, cones, herbs, wildlings (plant transplants), mushrooms, pine needles, and wildflowers. Harvesting these resources is a traditional use of the forest that precedes establishment of the national forests and grasslands, and is important to the cultural identity of local communities and to socioeconomic sustainability.

In recent years, the forest has provided approximately 3,020 Christmas trees, 350 wildlings, 1,140 pounds of nuts and seeds, 8.5 tons of limbs and boughs on an average decadal basis. In addition, on a decadal average, the forest provides 4.1 million cubic feet of fuelwood to area residents, many of whom rely entirely on wood to heat their homes in the winter months. The Gila also provides approximately 3.7 million cubic feet of saw timber, and 1.9 million cubic feet of other wood products[bb] for both personal and commercial use (posts, poles, etc.).

This use has changed dramatically over the years with national and regional shifts in social values, environmental regulations, and forest conditions. Historic overgrazing, fire suppression and even-aged management resulted in homogenous stands at greater risk to wildfire and epidemic-level insect and disease outbreaks. In the 1990s, timber harvest methods shifted away from even-aged management to uneven-aged thinning and group selection in ponderosa pine and mixed conifer forests. This shift in management was the result of changing management objectives, generally geared toward reducing the impacts of timber harvesting on habitat for endangered species such as the Mexican spotted owl, and reducing fuels to lessen the threat of wildfire in the WUI. Since the adoption of the 1986 forest plan, changes in vegetation management have resulted in a steady decline in timber harvesting, forest industry, and infrastructure.

Despite these reductions, the harvest of forest products remains a benefit to people, wildlife habitat, and ecosystem and watershed health. Recent harvesting activities have been focused on these objectives, rather than solely a timber production objective. With the help of partners, an average of 17,986 acres per year were treated between 1996 and 2014 (USDA FS Gila NF 2017). The forest currently supports only local operators and mills due to low product value and long haul distances. Industry capacity and product value is low compared to what it was once, due to the prevalence of small-diameter trees that provide less volume per acre. Due to the warm, arid to semi-arid climate of the forest, growth rates are very slow compared to many other areas in the United States, lengthening the amount of time between harvests in the same area. Challenges to providing forest products include litigation, economic constraints, and declining Forest Service budgets.

In terms of timber, most of the commercially available species in the forest are ponderosa pine, Douglas-fir, southwestern white pine, and spruce (FIA EVALIDator 2018), although other desirable species are present in low numbers. A periodic national inventory is conducted by the Forest

[bb] Volumes reported in the assessment were found to be in error. The corrected volumes presented here were calculated from the volume of products sold between 2005 and 2018.

Service's Forest Inventory and Analysis (FIA) program. FIA plot data were summarized using EVALIDator standard reports from 2005 to 2016 inventory data to produce statistically valid estimates of stocking characteristics of these species on Gila NF lands, excluding those lands removed from timber harvest by legislation, such as designated wilderness areas. These estimates follow in table 44 and table 45.

Table 44. Number of commercially desirable tree species and volume estimates for the Gila NF lands outside of existing designated wilderness (FIA EVALIDator 2018)

Tree Species	Stocking Variable					
	Number of Growing Stock Trees (millions)	Number of Live Seedlings (millions)	Net Merchantable Volume of Live Trees All Slope Gradients (million cubic feet)	Net Merchantable Volume of Live Trees Slopes ≤ 40%	Sawlog Volume of Live Trees All Slope Gradients	Sawlog Volume of Live Trees Slopes ≤ 40%
Ponderosa pine	57.2	30.8	819.5	741.6	716.3	646.2
Douglas-fir	9.8	18.6	103.6	75.6	82.7	60.9
Southwestern white pine	2.5	6.5	24.5	11.6	20.0	8.8
Spruce	0.4	ND	6.9	6.9	6.0	6.0
Totals	69.9	55.9	954.5	828.9	825.0	721.8

Table 45. Estimated size class distribution (by diameter class in inches) of all commercially desirable species of live trees in the Gila NF at least 5 inches in diameter outside of designated wilderness areas (FIA EVALIDator 2018)

Estimated diameter class in inches	Percentage of commercially desirable species
5.0–6.9	26
7.0–8.9	23
9.0–10.9	17
11.0–12.9	12
13.0–14.9	8
15.0–16.9	6
17.0–18.9	3
19.0–20.9	2
21.0–22.9	2
23.0–24.9	1
25.0–26.9	<1
27.0–28.9	1
29.0–30.9	<1
31.0–34.9	<1
41.0+	<1

These data also suggest that outside of designated wilderness, there is an average annual net loss of live volume associated with these species of 2.3 million cubic feet due to mortality (FIA EVALIDator 2018). Tree mortality may result from several different causes, or combination of causes, including drought, fire, insects or disease. Salvage harvest of dead volume occurs where it is economically viable and local operators or individuals are interested in the available products.

The availability of products is likely to change in the future with predicted increases in frequency, duration and severity of drought conditions and a corresponding shift in natural disturbance regimes. Some evidence suggests the type, amount and distribution of available forest products could change substantially in future decades (Parks et. al 2018a; Stevens-Rumann et. al 2018; McDowell et al. 2015 among others) making local communities highly vulnerable to potential socioeconomic impacts (Hand et. al 2018). Nevertheless, the harvest of timber, forest and botanical products are expected to remain economically and ecologically important over the life of the revised forest plan. Furthermore, if harvest can facilitate ecological restoration at landscape scales, it may increase the availability of forest products over the life of the revised forest plan.

Plan-Level Environmental Consequences

The following discussion of environmental consequences addresses the effects of the alternatives on timber, forest and botanical product extraction as a use of the forest. It does not discuss the effects of their uses on natural resources or other resource uses. Those discussions are housed under their respective topic headings.

Analysis Methodology

The National Forest Management Act of 1976 (16 U.S.C. 1600), commonly called NFMA, is the basic law that guides land management planning on national forests and grasslands. Congress enacted the NFMA in 1976, and, like all laws, it is a product of the social and political issues at that time. Beginning in the 1950s, the Forest Service was called upon to provide large amounts of wood products for the marketplace and did so, using industrial forest management techniques that emphasized maximum production. As harvest levels increased over time, Congress and members of the public became increasingly concerned about the impacts of such intensive forest management. The NFMA was enacted in response to those public concerns, most notably concerns associated with clearcutting. Consequently, the law has numerous specific timber management requirements that focus on the regulation of timber harvesting practices, especially clearcutting. The political environment and social values have changed substantially since the NFMA was enacted, and the largely utilitarian views of the 1950s have given way to a more balanced and integrated view of national forest management.

Nevertheless, the NFMA requires the agency to determine the suitability of National Forest System lands for timber production and has specific requirements for timber production suitability analyses in land management plans. These requirements are supported by the 2012 Planning Rule and associated Forest Service directives, which add additional analysis requirements and considerations. Under the 2012 Planning Rule and directives, land management plans now focus on desired conditions (outcomes) rather than the production of goods and services (outputs) to better provide for multiple use on a sustained yield basis, in perpetuity.

Four of these requirements are used to evaluate the effects of plan direction on the sustainable extraction of forest products: timber production suitability, sustained yield limit, estimated vegetation management practices and projected harvest levels. These requirements and the methodology employed to analyze them are described in the following subsections.

Timber Production Suitability

Timber harvest may be considered a resource use (timber production) or a tool (activity to improve or restore healthy forest conditions). As a resource use, the timber production objective is defined as the growing, tending, harvesting and regeneration of crops of trees on a regulated basis to produce logs or other products for industrial or consumer use. Under the timber production objective, regular, periodic timber harvest is predictable and supports the achievement and maintenance of non-timber related desired conditions. It does not require or imply that timber yields be maximized.

Where timber production is not the objective, harvest may be unpredictable, unnecessary, or undesirable based on desired conditions and management goals, but may be permitted as deemed necessary to achieve resource protection, restoration and/or human safety objectives. Removing encroaching trees from historic grasslands, or hazardous fuels reduction in an overgrown forest are examples of restoration and/or resource protection objectives.

The 2012 Planning Rule, supported by the Forest Service national directives, specifically Forest Service Handbook, FSH 1909.12 Chapter 60, outlines two steps in the interdisciplinary, timber production suitability process:

Step 1: Identification of lands that may be suited for timber production and those that are not suited for timber production based on legal and technical factors

Step 2: Identification of lands suited and not suited for timber production based on compatibility with desired conditions and objectives

To complete Step 1, the interdisciplinary team applies a set of screening criteria to identify:

1. Lands on which timber production is prohibited (by executive order or regulation) or lands withdrawn from timber production (by the Secretary of Agriculture or Chief of the Forest Service)[cc].
2. Lands on which technology to harvest timber is not currently available without causing irreversible damage to soil, slope or other watershed conditions in the plan area.
3. Lands on which there is no reasonable assurance that lands can be adequately restocked within five years of final regeneration harvest.
4. Lands that are not forest lands.

Appendix C: Timber Production Suitability, Estimated Vegetation Management Practices and Projected Harvest Levels Methodology provides details about the Gila NF interdisciplinary approach, rationale and assumptions associated with Step 1. Lands that meet one or more of these criteria are identified as lands that are not suitable for timber production. Lands that do not meet any of the legal or technical criteria are considered lands that may be suitable for timber production. Lands that may be suitable move on to be evaluated in Step 2. This determination does not change with plan alternative. However, they are subject to a mandatory review every ten years at a minimum. The purpose of this mandatory review is to determine if conditions have changed such

[cc] These are designated wilderness, wilderness study areas, designated Research Natural Areas, and eligible Wild and Scenic River segments.

that a new suitability analysis is warranted. As a result of this review, the plan may be amended to reflect any relevant changes.

In Step 2, all lands that *may* be suitable for timber production are determined to be either suited or unsuited for timber production based on compatibility with desired conditions and objectives. While the outcomes of Step 1 are the same for every alternative, the outcomes of Step 2 vary by alternative. The primary considerations involved in Step 2 are desired conditions and objectives for IRAs, recommended wilderness other proposed designations, soil and watershed, and upland vegetation. Each alternative has its own suitability analysis, including alternative 1. Per NFMA, even though alternative 1 is the no-action alternative, this new suitability analysis replaces the one supporting the 1986 forest plan.

Sustained Yield Limit

Timber harvest must be based on the principle of sustained yield. The sustained yield limit is an estimate of the amount of timber that could be sustainably harvested from lands that *may* be suitable for timber production in perpetuity under a set of specified management practices. It serves as a benchmark to ensure the supply of timber is sustainable and represents the maximum volume of timber which could be sold, except under certain circumstances defined by NFMA (16 USC 1600, 36 CFR 219.11(d)(6)). The process of calculating the sustained yield limit was developed by the Forest Service Southwestern Regional Office (Youtz and Vandendriesche 2015) and is described in more detail in appendix C. It includes the following assumptions relevant to the Gila NF and the plan alternatives.

- The management of Ponderosa Pine Forest and Ponderosa Pine-Evergreen Oak favors ponderosa pine.
- The management of Mixed Conifer-Frequent Fire favors the dominance of shade intolerant species such as ponderosa pine, Douglas-fir, and southwestern white pine.
- The management of Mixed Conifer with Aspen and Spruce-Fir Forest favors dominance of wind-firm species such as Douglas-fir and southwestern white pine.
- Group selection cutting methods on a 30-year cutting cycle with six age-classes. Intermediate thinning may be combined with group selection cutting methods.
- Group and/or patch sizes and density increase by Ecological Response Unit (ERU) as forest conditions become progressively cooler and wetter.
- Target matrix density varies by ERU.

Estimated Vegetation Management Practices

Estimated vegetation management practices describe the general types of cutting methods that are likely to be prescribed in each forest/timber type ERU and how many acres of each type of cutting method are anticipated. It does not include woodland or grassland ERUs. These are derived from objectives associated with each alternative, the silvicultural input used for the state-and-transition modeling, and model outputs. This is described in detail in appendices B and C.

The objectives for each alternative were developed under the assumption that future congressionally allocated dollars for vegetation management in the Gila NF will remain similar to the 2007–2017 time period. Perhaps, what is more important is what is not assumed. While the forest has been fortunate to have many partners who have generously contributed time, dollars, and other resources to accomplish restoration treatments over the years, staff and leadership believe that partnership dollars cannot be taken for granted. Competition for those dollars is high, and their availability can vary widely based on numerous factors beyond the potential influence of Gila NF staff and leadership. Therefore, the objectives were developed under the assumption that no partnership dollars are available. If budgeted dollars change substantially from the 2007–2017 time period, these volumes could change. If partnerships and associated funding make additional treatment possible, volumes will change. Changes are also likely depending on project locations, site-specific conditions and appropriate silvicultural prescriptions. It is also dependent on having site-specific, project-level environmental analyses completed.

For all alternatives except alternative 1, it is assumed acres treated within the WUI are distributed among vegetation types in proportion to the amount of area within the WUI that each type occupies. Alternative 1 assumes the distribution of WUI treatment acres remains as it was between 2007 and 2017.

Projected Harvest Levels

The projected timber sale quantity (PTSQ) is the volume of timber projected to be sold over a specified time period. Projected wood sale quantity (PWSQ) is the projected timber sale quantity *plus* the volume of other wood products projected to be sold in association with timber sales and other types of harvesting activities in woodland ERUs. It does **not** include volume removed under personal use permits for fuelwood or other forest products. Under all alternatives, the volume of personal use wood products is assumed to be relatively constant over time. While the volume may vary in the future, that variation will be based on the number of permits purchased by the public, not on decisions made by the Gila NF. The supply of volume to support personal use permits is expected to exceed demand under any reasonably foreseeable scenario.

Both PTSQ and PWSQ are calculated based on state-and-transition modeling outputs and regionally developed coefficients that related acres treated to volume outputs by ERU, pre-treatment vegetation conditions and thinning treatments. More details related to these calculations can be found in Appendix C. The discussion related to assumptions, limitations and sources of variability from the projected values described in the previous section are also relevant here.

Effects Common to All Alternatives

The availability of forest products for ceremonial and traditional tribal use will continue and does not change with alternative. This sustains the tribes' traditional, cultural and spiritual uses of the forest that have spanned centuries. All alternatives provide the opportunities for the public to collect fuelwood and other forest and botanical products under permit, which sustains ways of life and family traditions, and contributes to the economic stability of the rural communities surrounding the forest. It also connects people to the land, which cultivates a sense of stewardship.

The volume or other quantity of these products provided under permit is projected to remain relatively stable, but may vary in the future based on the permits purchased by the public, not by management decision. Supply is expected to exceed demand under any reasonably foreseeable scenario. Additional forest products such as fuelwood and posts, poles and stays, will also be available as by-product of restoration treatments under all alternatives, with effects similar to products provided through permits as previously described.

All alternatives have a sustained yield limit of 583 million board feet (MMBF) or 130 million cubic feet (MMCF) and provide for some level of timber and other harvesting activities that contributes revenue and job opportunities to local and regional communities. All include mechanical treatments for forest restoration, fuels reduction, or both which may produce commercial timber, small-diameter timber, fuelwood or other biomass as by-products. Reducing tree densities can reduce competition between trees, leading to enhanced vigor and growth in the remaining trees and potentially leading to higher quality timber in the future. Uneven-aged forest management, including group selection and free thinning, is a feature of all alternatives that is not only ecologically sound, but helps make 30-year cutting cycles sustainable in the arid and semi-arid Southwest where even thinning-enhanced growth rates are slow[dd].

Thinning can also reduce the risk for product loss due to high-severity wildfire and epidemic levels of insect and disease, and lead to positive or negative changes in site moisture characteristic. Changes in site moisture characteristics have implications for product loss through drought stress and mortality. In the short-term, thinning can mitigate water stress (Clark et. al 2016; Bradford and Bell 2017; among others). However, with enhanced growth rates, water demand in the residual trees and understory vegetation increases, as do evaporative losses, which may increase vulnerability to drought over the long-term (Brauman et. al 2007; Clark et al. 2016; Moreno et al. 2016). The success of any given thinning intensity to reduce moisture stress will likely differ based on local site, soil, and stand conditions (Meyer et al. 2007 in North et al. 2009).

A suitable land base for timber has the potential to create jobs, support existing and new timber-related industries, generate revenue and support a way of life valued by local communities. This potential is proportionate to the amount of suitable area and the market value of the products it contains. In terms of timber harvest as a thinning activity, a suitability determination of not suited for timber production does not necessarily preclude timber harvest for other reasons unless the area is not suited for timber production based on legislation that prohibits timber harvest. Where not prohibited by law, thinning activities in areas not suited for timber production may provide products to people, but cannot be relied upon on a routine basis to support local and regional markets and contribute financially to area residents.

Inventoried roadless areas are not suited for timber production, based on desired conditions under all alternatives. The desired conditions for these areas are the same across all alternatives in compliance with the requirements of the regulation that established them. While timber could legally be removed from these areas, regular cycles of timber harvest require road infrastructure, which is inconsistent with the intent of the clause in the Roadless Rule that allows for roads to be used to harvest timber under specified exceptional circumstances. Aerial operations on a regulated, periodic basis are not economically feasible, nor are they likely to benefit local economies, as those technologies are not currently available locally and would require a substantial investment by local operators. For these reasons, approximately 184,929 acres of IRAs are removed from suitability under all alternatives without a measurable decrease in the ability of the forest to contribute to jobs and revenue to local economies.

Proposed research natural areas (RNAs) are determined to be not suited for timber production based on the desired conditions, nor is the harvest of other forest and botanical products consistent with RNA status. The no-action alternative carries forward the four existing proposed RNAs totaling 1,944 acres. None of these areas contains lands that would be suited for timber production were they not proposed, predominantly because they do not contain forested/timberland vegetation (see

[dd] There are some instances where even-aged management is appropriate and necessary. These instances include sanitation harvest for forest health. Even-aged cutting methods are necessary to address forest health agents such as mistletoe and beetle infestations, or for special objectives such as aspen or spruce-fir regeneration.

Appendix H: Research Natural Area Evaluation Process). While the other alternatives vary in terms of whether or not they carry some, none or all of the existing proposals forward, there is no substantial effect to the availability of timber or other products given the vegetation communities they contain and the small number of acres involved. There are no new research natural area proposals under any alternative, and no other proposed designations that would preclude timber harvest for the purposes of timber production.

All alternatives establish soil and slope-based BMPs as plan standards to support maintenance of desired conditions for soil and watershed. These standards contain caveats to accommodate any site-specific trade-offs that might exist between mechanical vegetation treatments, potential damage associated with high-severity wildfire, and WUI values. If harvest is necessary to protect watershed or WUI values, it is allowable. However, regular cycles of timber harvest are not. This removes approximately 72,918 acres from suitability, which includes 22,925 acres of highly erodible Datil soils on slopes greater than 15 percent and 49,993 acres that either occur on erosional landforms or have little to no soil development on slopes greater than 25 percent. Soils with little to no development have low natural stability and are less resilient. Furthermore, some of these soils are not capable of producing a significant herbaceous response, due to natural soil properties, which leaves their stability entirely reliant on conifer canopy cover, basal area, coarse woody debris and needle litter. Removing these acres from suitability does not substantially reduce the forest's ability to contribute jobs and revenue to local economies, but it does reduce the reliability of contributions that these acres may provide as compared to the suitable timber base.

Similarly, another 54,259 acres of slopes over 40 percent are removed from suitability under plan standards to support maintenance of desired conditions for soil and watershed. This slope threshold represents the limitations of conventional, ground-based equipment. Specialized ground-based equipment or aerial operations would be required to harvest these acres, both of which substantially increase the cost per acre[ee] and would reduce the number of acres that could be harvested given fiscal limitations. No local operators have this equipment, and much less of the revenue generated by such harvest would benefit local economies. While harvesting on these slopes is not prohibited by plan standards, it is not economically feasible to do so on a routine basis. Furthermore, if operators from outside the local communities were brought in to do this work, the economic benefit to the local economy would be reduced. Lastly, 2,561 acres were removed from suitability because they represent pockets of suitable timber less than ten acres in size within larger areas that were determined not to be suited. These acres were removed because it is not economically realistic, and may not be operationally feasible to manage them for timber production. Therefore, this does not substantially reduce the forest's ability to contribute jobs and revenue to local economies.

Differences among alternatives arise in terms the number of acres suited for timber production, number of acres treated, and types of products and projected harvest volumes. These differences are tied to the ecosystem types treatments would focus on under a given alternative, methods used to accomplish treatments, and the amount of land that would be recommended to Congress to be considered for wilderness designation.

Wildland fire will continue to occur under all alternatives, although its role as a management tool varies among alternatives. Both prescribed and naturally ignited fire can be restoration and/or fuels management tools when used alone, or in conjunction with mechanical treatments. The science

[ee] Recent cost estimates obtained for a project on the Kaibab National Forest are approximately $3,000 per acre (pers. comm.2019) as opposed to the roughly $350 to $700 per acre cost the Gila NF has paid in recent years for conventional equipment.

suggests that neither mechanical treatments nor prescribed fire used alone produces a significant effect on nutrient availability. However, when used in combination, the effects are generally both significant and positive (Sánchez Meador et al. 2017 among others). Higher nutrient availability can enhance growth rates. On the other hand, there is literature indicating the significance of fire effects on nutrient cycling, and whether those effects are positive or negative, is dependent on soil heating thresholds (DeBano 1990; Busse et al. 2014). While it might be that these thresholds are not reached under most prescribed burning conditions, it does happen and can result in enhanced or reduced nutrient availability for a relatively short period of time (Busse et al. 2014). These thresholds are more often reached in wildfire scenarios, where unfavorable weather and fuel conditions support stand-replacement fire. Mixed- and high severity, whether as a result of prescribed or naturally ignited, wildfire can lower product values as fire-damaged timber generally has lower market value. While the potential for salvage sales exists under all alternatives, product values are typically lower which results in a potential loss of revenue. On lands suited for timber production, stand-replacement fire can also substantially lengthen the time between harvest cycles as it may take well over 30 years for stands to reestablish such that they are worth harvesting.

Effects Common to Alternatives 1 through 4

The area suitable for timber production can be viewed as an indicator of potential opportunity for the Gila NF to make reliable contributions to local and regional revenue and job opportunities if market forces and industry capacity were not factors. In terms of the area suitable for timber production, alternatives 1-4 are not substantially different with roughly one-tenth of a percent separating them (table 46, and figure 34 through figure 37). Therefore, there is not a substantial difference between these alternatives in terms of potential opportunity for timber production to contribute to jobs and revenue in local communities, stimulate markets or support industry innovations despite the fact that alternatives 2, 3 and 4 recommend approximately 110,402, 130,012, and 72,901 acres, respectively, to Congress for wilderness designation. Recommended wilderness is the sole variable driving differences between alternatives. Alternative 5's suitability determination is displayed and discussed under the alternative 5 heading because there is a substantial difference in the acres recommended to Congress for wilderness designation between alternative 5 and alternatives 1 through 4.

Table 46. Comparison of timber production suitability classifications under alternatives 1, 2, 3, and 4

Land Classification Category	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
A. Total area within the administrative boundary of the Gila National Forest	3,392,112*			
Lands within the administrative boundary that are not NFS lands (private property or other ownership)	119,972			
B. Lands not suited for timber production due to legal or technical reasons (B1+B2+B3+B4)	2,589,050			
B1. Lands not suited for timber production because it is prohibited. †	822,995			
B2. Lands not suited for timber production because the technology to harvest timber without causing irreversible damage is not available.	0			
B3. Lands not suited for timber production because there is no reasonable assurance of adequate restocking within 5 years of final regeneration harvest. ¥	338,694			
B4. Lands not suited for timber production because they are not forested. £	1,427,361			
C. Lands that *may* be suited for timber production (A–B)	683,090			
D. Total lands suited for timber production because timber production is compatible with the desired conditions and objectives established by the plan (C – E)	354,246	352,922	351,028	354,205
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan (C – D) ¤	328,845	330,168	332,062	328,885
F. Total lands not suited for timber production (B+E)	2,917,895	2,919,218	2,921,112	2,917,935

*Acreages of NFS lands may vary slightly over time due to factors such as resurvey, improved mapping technology and updates to corporate geospatial information systems (GIS) data.

†This includes existing congressionally designated wilderness areas (792,584 acres) and wilderness study areas (27,660 acres), eligible Wild and Scenic River segments with a preliminary classification of Wild (approximately 71,715 acres), existing designated RNAs (393 acres). In some cases, there is overlap between these kinds of areas. For example, many eligible Wild and Scenic River segments occur within existing designated wilderness. See also Appendix C. Timber Production Suitability, Estimated Vegetation Practices and Projected Harvest Levels Methodology.

¥This includes ecotones, or transition areas between woodland and forest/timberland types. On these moisture limited sites, ponderosa pine establishment and survival under the current climatic regime is episodic and site indices are low. Site indices are a measure of site productivity based on tree height, diameter and age. See also Appendix C. Timber Production Suitability, Estimated Vegetation Practices and Projected Harvest Levels Methodology.

£This includes woodland, grassland, shrubland and riparian Ecological Response Units. See also Appendix C. Timber Production Suitability, Estimated Vegetation Practices and Projected Harvest Levels Methodology.

¤This includes the acres previously identified and discussed under the effects common to all alternatives as being removed for soil and watershed desired conditions and vegetation objectives, as well as those acres of recommended wilderness included in the particular alternative. There may be overlap between areas removed due to incompatibility with desired conditions and objectives and recommended wilderness areas depending on the soils and slopes contained in a given recommended area.

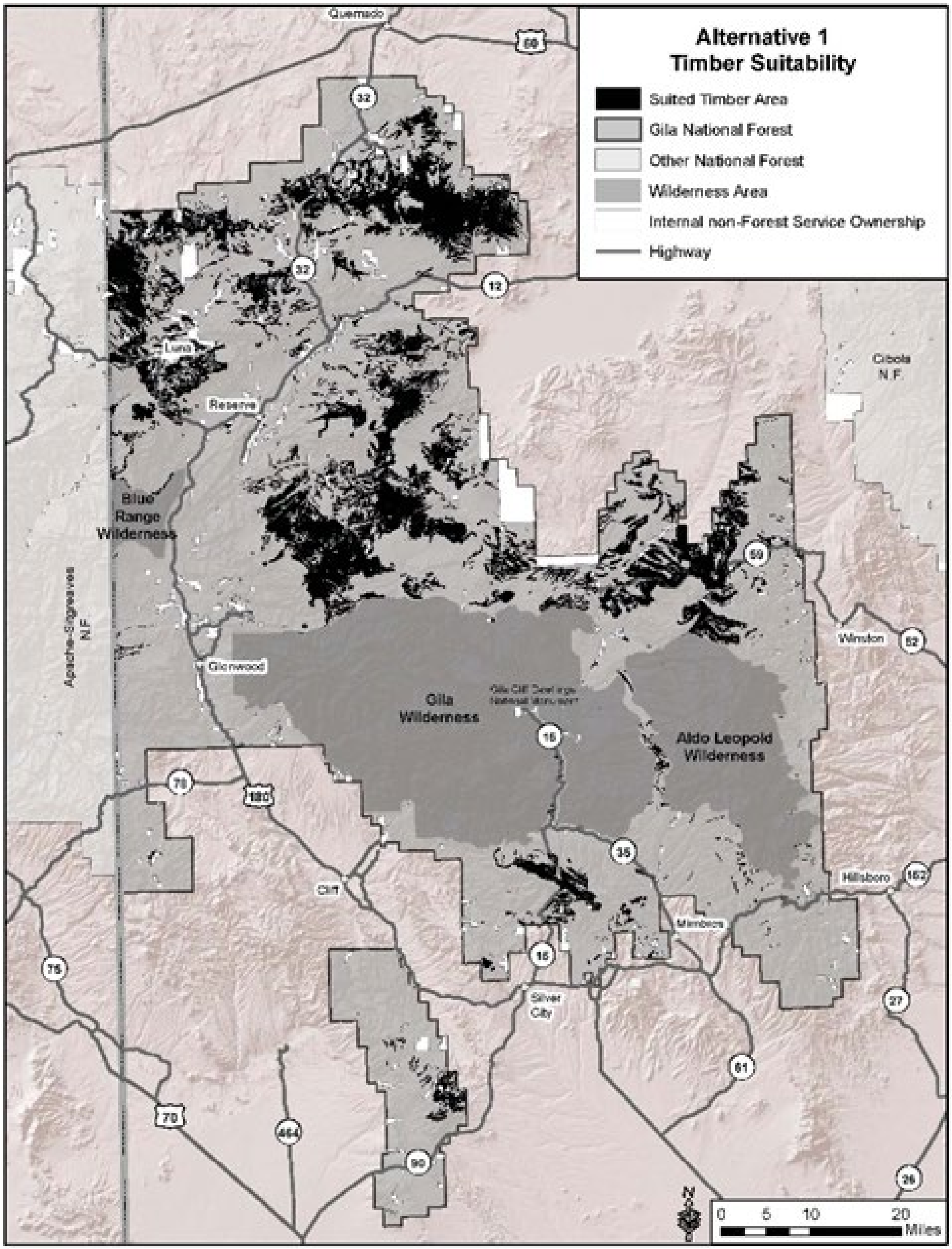

Figure 34. Suitable timber base under alternative 1

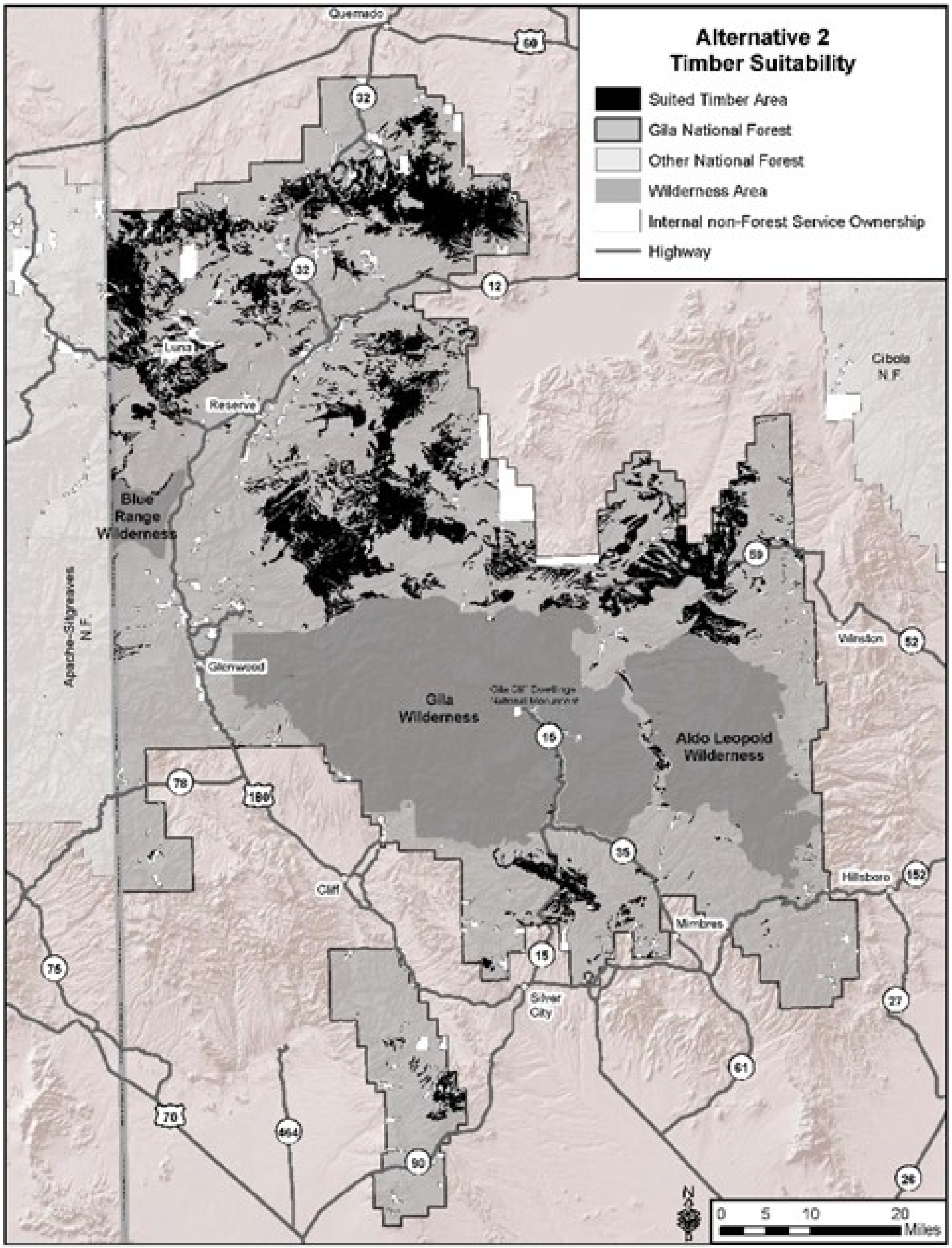

Figure 35. Suitable timber base under alternative 2

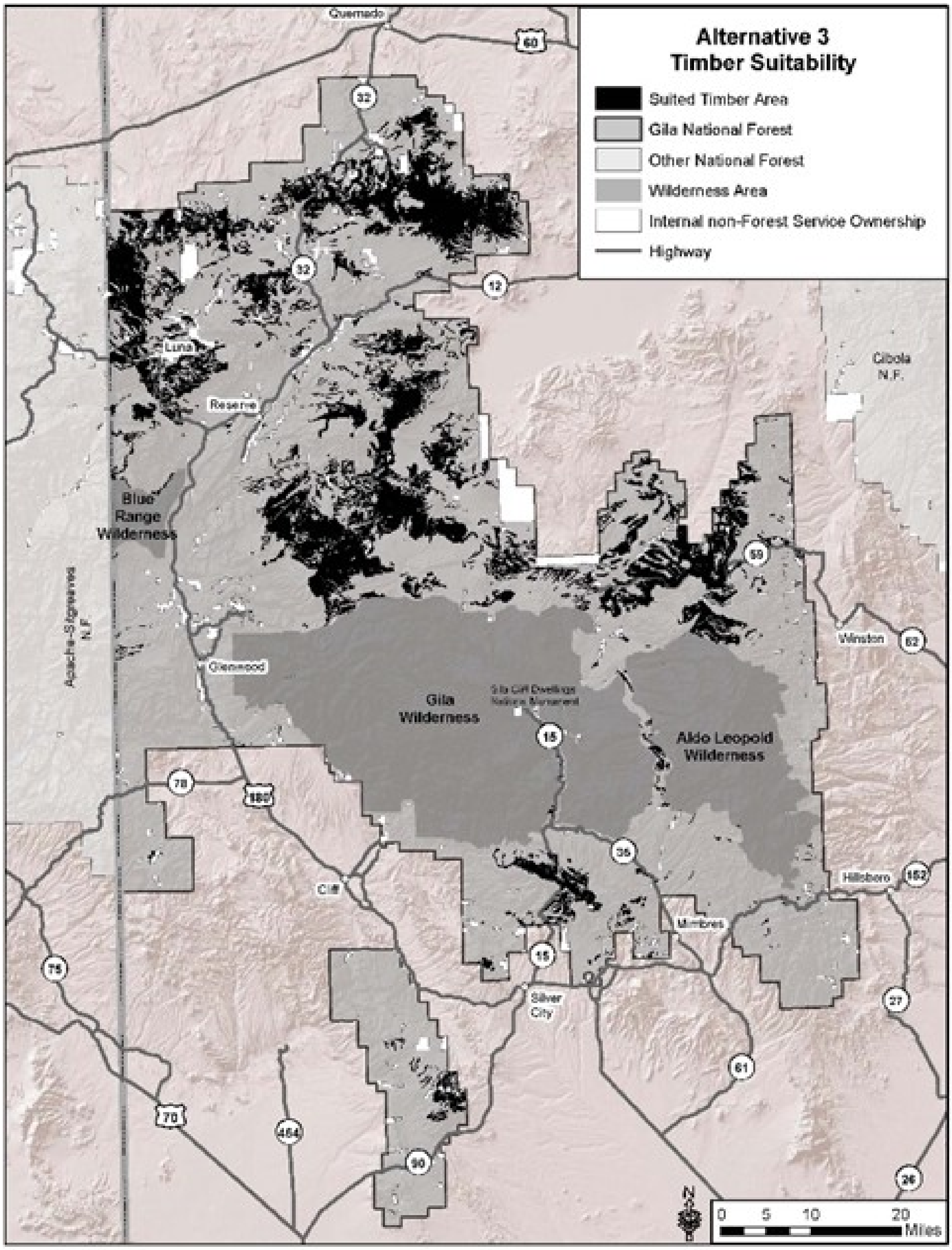

Figure 36. Suitable timber base under alternative 3

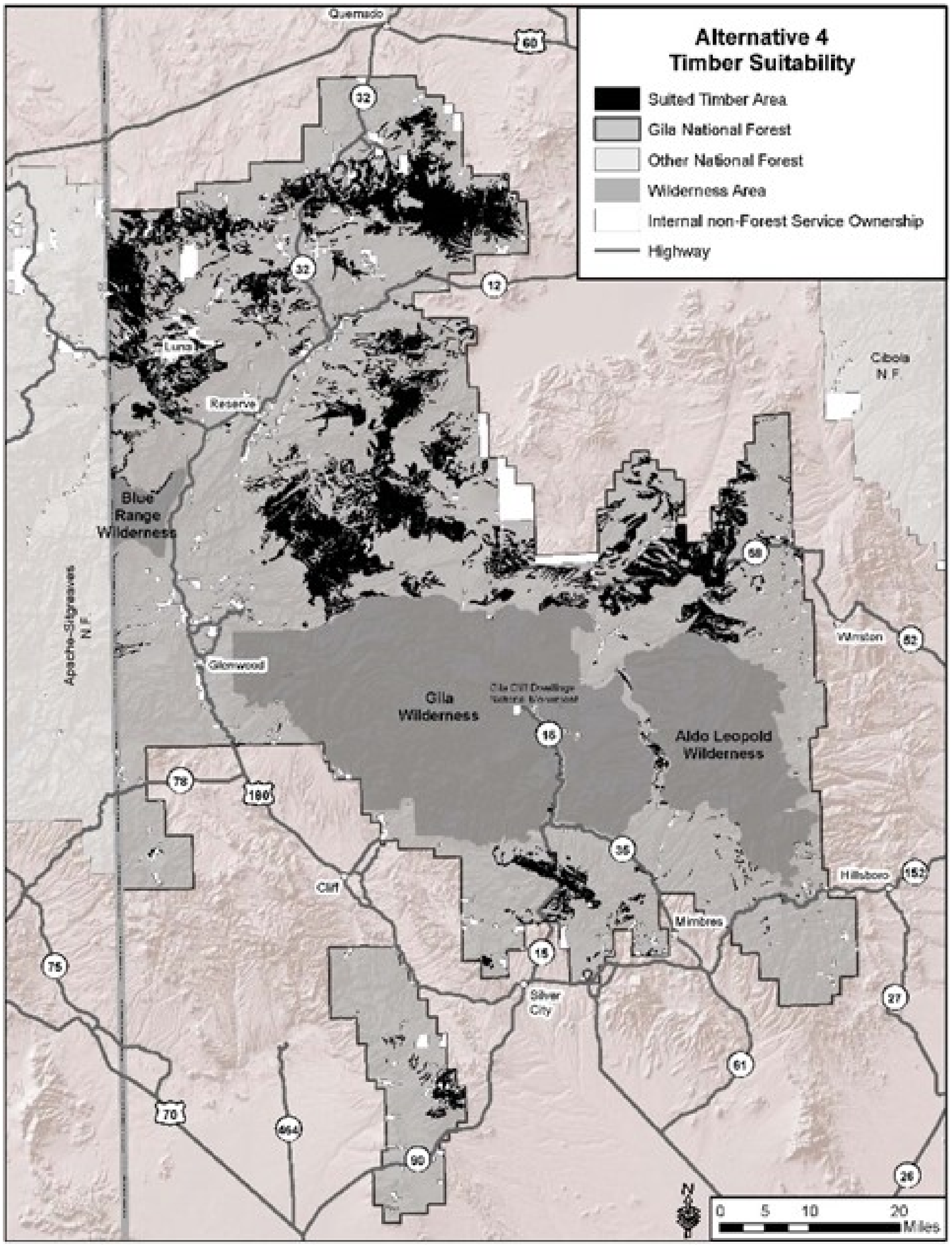

Figure 37. Suitable timber base under alternative 4

On the other hand, there are substantial differences in terms of how this opportunity is leveraged among these alternatives. These differences are related to the desired conditions for each vegetation type, the estimated vegetation practices and projected harvest levels proposed under each alternative. and are discussed in alternative-specific sections that follow.

Alternative 1 – No Action

Under the no action alternative, most vegetation types receive some acres of mechanical treatment that typically result in forest products being made available to local business and individuals, which has contributed jobs and revenue to local economies. In the timber types, Ponderosa Pine Forest has been the primary focus, followed by Ponderosa Pine-Evergreen Oak and Mixed Conifer-Frequent Fire. Treatments in Mixed Conifer with Aspen have been relatively incidental, occurring when relatively small areas are present within a project area. Table 47 provides the estimated vegetation management practices for timber types under alternative 1.

Table 47. Estimated forest-wide vegetation management practices in timber vegetation types under alternative 1 (shown in annual average acres per decade)

Forest Cover Types/ Vegetation Management Practices	1st Decade	2nd Decade
Ponderosa Pine Treatments		
Regeneration (Even-aged harvest)	539	831
Thinning (Even-aged Intermediate harvest)	3,155	3,100
Selection (Uneven-aged harvest)	12,620	12,399
Wet Mixed Conifer Treatments		
Regeneration (Even-aged harvest)	19	36
Thinning (Even-aged Intermediate harvest)	64	60
Selection (Uneven-aged harvest)	254	239
Dry Mixed Conifer Treatments		
Regeneration (Even-aged harvest)	0	117
Thinning (Even-aged Intermediate harvest)	121	102
Selection (Uneven-aged harvest)	486	408
Total Treatments		
Regeneration (Even-aged harvest)	557	968
Thinning (Even-aged Intermediate harvest)	3,340	3,262
Selection (Uneven-aged harvest)	13,360	13,046

On average, approximately 17,275 acres of harvesting activities in timber vegetation types, both within and outside the WUI, are projected to occur each decade with a strong emphasis on ponderosa pine types. Harvesting activities are also planned in woodlands and encroached grasslands with an additional average of 11,996 acres in woodland vegetation types and roughly 8,317 acres in encroached grasslands each decade. Treatments in woodlands and grassland systems provide additional wood products, including fuelwood, and may ease access into these areas for the collection of special forest products like piñon nuts.

Consider that there are 354,246 acres of suitable timber under alternative 1 (table 46). This means that in terms of timber production, a substantial portion of the potential economic opportunity remains untapped. Table 48 contains the PTSQ and PWSQ associated with treatments in timber and woodland vegetation types. It does not include wood that might be associated with grassland restoration because those systems are not being managed for a sustainable supply of wood products. Values are rounded to the nearest whole number or decimal place where a whole number would be reported as zero.

Table 48. Projected volume associated with estimated vegetation practices under alternative 1

Sustained Yield Limit (SYL)	**583 MMBF, 130 MMCF per decade**					
Timber Products	First Decade			Second Decade		
	MMCF	MMBF	Tons	MMCF	MMBF	Tons
	Volumes other than salvage or sanitation that meet timber product utilization standards					
Lands suitable for timber production						
A1. Sawtimber (industrial softwoods, 9”+)	6	29	92,589	8	39	118,932
A2. Other Products (industrial softwood, 5-9” - roundwood, commonly pulpwood, mostly in the form of fuelwood)	1		19,047	2		22,775
Lands not suitable for timber production						
B1. Sawtimber (9"+)	0.3	2	4,873	0.4	2	6,260
B2. Other Products (5-9")	0.1		1,002	0.1		1,199
C. **Projected Timber Sale Quantity (PTSQ)** (A1+A2+B1+B2)	8	30	117,511	10	41	149,165
Other Estimated Wood Products	Fuelwood, biomass, and other volumes that do not meet timber product utilization standards					
	MMCF		Tons	MMCF		Tons
D1. Non-industrial softwood fuelwood (5"+)	1		0.2	1		0.3
D2. Hardwood fuelwood (5"+)	0.5		0.2	1		0.2
D3. Aspen (5"+)	0.1		0.03	0.1		0.03
E. **Projected Wood Sale Quantity (PWSQ)** (C+D1+D2+D3)	9		117,512	12		149,166

The total decadal volumes projected to be produced under alternative 1 are very similar to the decadal average the forest has produced in the past (2005 and 2018), but the distribution of that volume between product types differs. The projected volume for the first decade under alternative 1 includes 6 MMCF of sawtimber, but the forest has only produced an average of 3.7 MMCF per decade. Several things may explain these differences, including site-specific conditions and appropriate silvicultural prescriptions. Projected volumes are based on regional averages, which may introduce error in the calculations where those averages do not reflect the actual volumes in a specific stand. Also, in recent years, the forest has offered timber sales and on occasion, received no bids. Whether this is a reflection of lack of interest, market conditions, industry capacity or some combination of these factors is speculative. Nevertheless, it has reduced the volume the Gila NF has been able to produce. Assuming all sales offered are sold, this alternative would continue to support existing timber and timber-related industries and may support a modest amount of growth in some markets.

Under alternative 1, harvesting activities and low severity prescribed fire are frequently used in conjunction and naturally ignited wildfires are managed for resource benefit based on proximity of WUI values, and weather and fuel conditions. In general, only 4 percent of natural ignitions have been managed for resource benefit. The rest have been suppressed (see Upland Vegetation, Fire

Ecology and Fuels). Given existing conditions, this does little to reduce the risk of damaging stand-replacement fires that can reduce the quantity and quality of timber, forest and botanical products and therefore the potential revenue and job opportunities provided under this alternative. Furthermore, when stand-replacement fire occurs within the suitable timber base, several harvest cycles could be missed before the area can produce the same quantity and quality of merchantable material again.

Alternative 2-Proposed Action

Similar to alternative 1, most vegetation types would receive some amount of mechanical treatments. However, the distribution of acres treated differs from alternative 1. Table 49 provides the estimated vegetation management practices for timber types under alternative 2. It includes acres within and outside the WUI. Alternative 2 maintains an emphasis on timber with approximately 16,463 acres of harvest in timber vegetation types, 9,940 acres of harvest in woodlands, and 7,861 acres in encroached grasslands on an average decadal basis. Total acres of projected harvest are less than alternative 1 due to an increased investment in prescribed fire. This reflects trade-offs made under this alternative between the cost per acre to move vegetation toward desired conditions and the socioeconomic benefit associated with forest products.

Table 49. Estimated forest-wide vegetation management practices in timber vegetation types under alternative 2 (shown in annual average acres per decade)

Forest Cover Types/ Vegetation Management Practices	1st Decade	2nd Decade
Ponderosa Pine Treatments		
Regeneration* (Even-aged harvest)	579	327
Thinning (Even-aged Intermediate harvest)	1,676	1,726
Selection (Uneven-aged harvest)	6,702	6,905
Wet Mixed Conifer Treatments		
Regeneration* (Even-aged harvest)	24	66
Thinning (Even-aged Intermediate harvest)	66	57
Selection (Uneven-aged harvest)	263	230
Dry Mixed Conifer Treatments		
Regeneration* (Even-aged harvest)	529	593
Thinning (Even-aged Intermediate harvest)	1,325	1,312
Selection (Uneven-aged harvest)	5,298	5,247
Total Treatments		
Regeneration* (Even-aged harvest)	1,133	986
Thinning (Even-aged Intermediate harvest)	3,067	3,095
Selection (Uneven-aged harvest)	12,263	12,382

Within the timber types, ponderosa pine types received fewer acres of treatment in favor of an increased emphasis on mixed conifer, which has received less attention under current management. This shift in emphasis reflects concerns about existing conditions in cooler, moister vegetation types, fire management and predicted climate change impacts. Within the ponderosa pine types, Ponderosa Pine Forest retains priority over Ponderosa Pine-Evergreen Oak. While treatment acres are reduced for both pine types, planned harvesting activities in Ponderosa Pine-Evergreen Oak are substantially reduced from alternative 1 due to the post-treatment evergreen oak response that has been observed. There is frequently a post-treatment increase in both evergreen oak and juniper species in every ERU where they are a component, but the response in terms of stems per acre and canopy cover has become particularly problematic in Ponderosa Pine-Evergreen Oak and is of substantial concern in the WUI. The increased density of these species alters forest composition and structure, the potential for future timber harvest, and fire behavior. These species have the competitive advantage in the warmer, drier post-treatment environment and may interfere with the establishment and growth of timber species. They also serve as ladder fuels, which may result in a shift from a frequent, low severity fire regime to a more variable, mixed-severity fire regime. This has been discussed in detail in the upland vegetation, fire ecology and fuels section of this DEIS. However, the objectives under alternative 2 have sufficient flexibility that harvest could be increased over projected levels should more successful methods and the funds to do so become available.

Similar to alternative 1, this alternative leaves much of the potential socioeconomic benefit associated with the amount of land suitable for timber production untapped, with only about 5 percent of the 352,922 acres suited for timber production being harvested each decade. Table 50 contains the PTSQ and PWSQ associated with treatments in timber and woodland vegetation types. It does not include wood that might be associated with grassland restoration because those systems are not being managed for a sustainable supply of wood products. Values are rounded to the nearest whole number or decimal place where a whole number would be reported as zero.

Table 50. Projected volume associated with estimated vegetation practices under alternative 2

Sustained Yield Limit (SYL)	**583 MMBF, 130 MMCF per decade**					
Timber Products	First Decade			Second Decade		
	MMCF	MMBF	Tons	MMCF	MMBF	Tons
	Volumes other than salvage or sanitation that meet timber product utilization standards					
Lands suitable for timber production						
A1. Sawtimber (industrial softwoods, 9”+)	8	35	115,153	5	24	78,972
A2. Other Products (industrial softwood, 5-9” - roundwood, commonly pulpwood, mostly in the form of fuelwood)	3		22,497	1		15,093
Lands not suitable for timber production						
B1. Sawtimber (9"+)	0.4	2	6,061	0.3	1	4,156
B2. Other Products (5-9")	0.1		1,184	0.1		794
C. **Projected Timber Sale Quantity (PTSQ)** (A1+A2+B1+B2)	11	37	144,894	7	25	99,016
Other Estimated Wood Products	Fuelwood, biomass, and other volumes that do not meet timber product utilization standards					
	MMCF		Tons	MMCF		Tons
D1. Non-industrial softwood fuelwood (5"+)	1		0.3	1		0.2
D2. Hardwood fuelwood (5"+)	0.4		0.2	0.2		0.1
D3. Aspen (5"+)	1		0.1	0.3		0.1
E. **Projected Wood Sale Quantity (PWSQ)** (C+D1+D2+D3)	13		144,895	8		99,016

Despite these differences, on the decadal average, alternative 2 is not substantially different from alternative 1 in terms of projected volume. Assuming all sales offered are sold, this alternative would also continue to support existing timber and timber-related industries and may provide for a modest amount of growth in some markets.

Also similar to alternative 1, alternative 2 uses harvesting activities, and prescribed and naturally ignited wildfire. However, alternative 2 places a slightly higher emphasis on prescribed fire in order to move more acres toward desired conditions. It also takes on more risk by allowing more mixed-severity fire to occur on the landscape and by managing more natural ignitions. This increases both the potential beneficial and detrimental effects associated with fire identified as common to all alternatives.

This could mean an increase in the number of treated acres on which the vigor and growth of residual trees are demonstrated, providing higher value products to local industries over the long term, but could be accompanied by salvage sales and lower value products over the short term. However, this alternative does more to reduce the risk of large, contiguous extents of high-severity wildfire, which protects product value and contributions the forest can make to jobs and revenue over the long term.

Alternative 3

Dissimilar to alternatives 1 and 2, this alternative focuses exclusively on woodland and grassland vegetation types based on stakeholder concerns about the lack of progress being observed in these systems. As a result, the only timber production potential that is tapped into is in the Wildland Urban Interface, where mechanical treatments may produce timber in proportion to how much of the WUI occurs within timber vegetation types. The potential is essentially the same, it just isn't used outside the WUI. Table 51 provides the estimated vegetation management practices for vegetation types under alternative 3.

Table 51. Estimated forest-wide vegetation management practices in timber vegetation types under alternative 3 (shown in annual average acres per decade)

Forest Cover Types/ Vegetation Management Practices	1st Decade	2nd Decade
Ponderosa Pine Treatments		
Regeneration* (Even-aged harvest)	72	0
Thinning (Even-aged Intermediate harvest)	313	328
Selection (Uneven-aged harvest)	1,253	1,340
Wet mixed conifer/spruce-fir Treatments		
Regeneration* (Even-aged harvest)	0	18
Thinning (Even-aged Intermediate harvest)	11	7
Selection (Uneven-aged harvest)	42	29
Dry mixed conifer Treatments		
Regeneration* (Even-aged harvest)	0	0
Thinning (Even-aged Intermediate harvest)	55	55
Selection (Uneven-aged harvest)	222	222
Total Treatments		
Regeneration* (Even-aged harvest)	72	18
Thinning (Even-aged Intermediate harvest)	379	390
Selection (Uneven-aged harvest)	1,517	1,591

On average, 1,968 acres of harvesting activities in timber types are projected to occur in the WUI along with 33,940 acres of woodland treatments and 15,900 acres of grassland restoration. The total acres of treatments increases significantly as opposed to alternatives 1 and 2 because there is significantly less investment being made in the use of prescribed fire, which frees up additional funds for mechanical treatments. Table 52 contains the PTSQ and PWSQ associated with treatments in timber and woodland vegetation types. It does not include wood that might be associated with grassland restoration because those systems are not being managed for a sustainable supply of wood products. Values are rounded to the nearest whole number or decimal place where a whole number would be reported as zero.

Table 52. Projected volume associated with estimated vegetation practices under alternative 3

Sustained Yield Limit (SYL)	**583 MMBF, 130 MMCF per decade**					
Timber Products	First Decade			Second Decade		
	MMCF	MMBF	Tons	MMCF	MMBF	Tons
	Volumes other than salvage or sanitation that meet timber product utilization standards					
Lands suitable for timber production						
A1. Sawtimber (industrial softwoods, 9”+)	1	6	20,121	0.8	4	12,650
A2. Other Products (industrial softwood, 5-9” - roundwood, commonly pulpwood, mostly in the form of fuelwood)	0.2		3,391	0.2		2,397
Lands not suitable for timber production						
B1. Sawtimber (9"+)	0.1	0.3	178	0.04	0.2	666
B2. Other Products (5-9")	2		1,978	0.01		126
C. **Projected Timber Sale Quantity (PTSQ)** (A1+A2+B1+B2)	2	7	25,669	1	4	15,839
Other Estimated Wood Products	Fuelwood, biomass, and other volumes that do not meet timber product utilization standards					
	MMCF		Tons	MMCF		Tons
D1. Non-industrial softwood fuelwood (5"+)	15		4	4		1
D2. Hardwood fuelwood (5"+)	1		0.5	1		0.4
D3. Aspen (5"+)	0.03		0.01	0.04		0.01
E. **Projected Wood Sale Quantity (PWSQ)** (C+D1+D2+D3)	18		25,673	6		15,840

There are substantial declines in sawtimber volume projected under this alternative. On the other hand, the volume of fuelwood and other wood products are projected to substantially increase. This alternative has the potential to put the local timber industry out of business, which would result in a loss of revenue and job opportunities. While the local timber industry could theoretically be replaced by a new business model capable of using the products made available under this alternative, such as a biomass energy-generation plant, such businesses are not currently operating within economically feasible haul distances. Start-up costs could be prohibitive for most local residents and businesses within the life of the revised plan without grant funding or some other kind of subsidy or incentive. It is unlikely that any market or industry growth that could take advantage of these products would be able to compensate for the loss of the timber industry.

While wildland fire remains a tool under alternative 3, the decreased emphasis on its use means fewer acres are treated overall and the risk to forest products is not substantially lessened by the harvesting activities projected under this alternative. This makes the likelihood of large extents of stand-replacement wildfire and the associated detrimental effects to forest products identified as common to all alternatives is greater than alternative 1 or 2. There are also implications for future timber management options beyond this planning cycle, given the emphasis on treating woodlands and grasslands. Stand-replacement fire will more likely occur in both suited and unsuited timber that does not receive thinning treatments.

Alternative 4

In contrast to alternative 3, alternative 4 focuses exclusively on timber vegetation types based on stakeholder interests and concerns about the local timber industry. Woodland and grasslands are only harvested in the WUI. Table 53 displays the estimated vegetation management practices for timber types.

Table 53. Estimated forest-wide vegetation management practices in timber vegetation types under alternative 4 (shown in annual average acres per decade)

Forest Cover Types/ Vegetation Management Practices	1st Decade	2nd Decade
Ponderosa Pine Treatments		
Regeneration* (Even-aged harvest)	3,138	2,499
Thinning (Even-aged Intermediate harvest)	7,546	7,674
Selection (Uneven-aged harvest)	30,184	30,695
Wet Mixed Conifer Treatments		
Regeneration* (Even-aged harvest)	28	40
Thinning (Even-aged Intermediate harvest)	65	63
Selection (Uneven-aged harvest)	260	250
Dry Mixed Conifer Treatments		
Regeneration* (Even-aged harvest)	1,385	1,396
Thinning (Even-aged Intermediate harvest)	2,278	2,276
Selection (Uneven-aged harvest)	9,114	9,106
Total Treatments		
Regeneration* (Even-aged harvest)	4,552	3,935
Thinning (Even-aged Intermediate harvest)	9,889	10,013
Selection (Uneven-aged harvest)	39,558	40,051

On average, 53,998 acres of harvest per decade are projected for timber vegetation types under alternative 4, with 1,940 acres of woodland harvest and 462 acres of grassland restoration. As with alternative 3, less investment in prescribed fire allow more acres of mechanical harvest to occur. In terms of volume, sawtimber volumes are expected to increase 6-fold and the total volume of wood products is projected to quadruple over what is projected under alternative 1. Table 54 contains the PTSQ and PWSQ associated with treatments in timber and woodland vegetation types. It does not include wood that might be associated with grassland restoration because those systems are not being managed for a sustainable supply of wood products. Values are rounded to the nearest whole number or decimal place where a whole number would be reported as zero.

Table 54. Projected volume associated with estimated vegetation practices under alternative 4

Sustained Yield Limit (SYL)	**583 MMBF, 130 MMCF per decade**					
Timber Products	First Decade			Second Decade		
	MMCF	MMBF	Tons	MMCF	MMBF	Tons
	Volumes other than salvage or sanitation that meet timber product utilization standards					
Lands suitable for timber production						
A1. Sawtimber (industrial softwoods, 9"+)	28	128	420,205	28	130	414,731
A2. Other Products (industrial softwood, 5-9" - roundwood, commonly pulpwood, mostly in the form of fuelwood)	6		86,443	5		77,582
Lands not suitable for timber production						
B1. Sawtimber (9"+)	1	7	22,116	1	7	21,828
B2. Other Products (5-9")	0		4,550	0		4,083
C. **Projected Timber Sale Quantity (PTSQ)** (A1+A2+B1+B2)	36	134	533,314	35	137	518,224
Other Estimated Wood Products	Fuelwood, biomass, and other volumes that do not meet timber product utilization standards					
	MMCF		Tons	MMCF		Tons
D1. Non-industrial softwood fuelwood (5"+)	2		0.6	2		0.6
D2. Hardwood fuelwood (5"+)	2		0.9	2		0.8
D3. Aspen (5"+)	1		0.3	1		0.2
E. **Projected Wood Sale Quantity (PWSQ)** (C+D1+D2+D3)	41		533,316	40		518,226

Under this alternative, the forest's ability to sustain existing timber and timber-related industries and contribute to economic growth is substantially greater than the other alternatives, but projected volumes still do not approach the sustained yield limit. As previously mentioned, the forest has offered timber sales in the recent past and on occasion, received no bids. Perhaps this alternative could inspire greater confidence in the reliable availability of products and invigorate local industry. However, given current markets and industry capacity, this level of harvest within the analysis timeframe may not be realistically achievable.

As in alternative 3, more acres of mechanical harvesting is possible due to a decreased emphasis on prescribed fire. However, the effects are different with the emphasis being placed on timber vegetation types. In the timber types, existing conditions are either maintained or improved over alternative 1 and the risk of product or value loss resulting from high-severity fire in these types is reduced and more acres of timber may experience enhanced growth rates. On the other hand, research suggests that mechanical treatments alone favors the dominance of woody species in the understory that may compete with the establishment and growth of higher value timber species (in the sense of Goodwin et al. 2018) and serve as ladder fuels that can increase the likelihood of stand-replacement fire. Over time, this could reduce the forest's potential to produce timber and contribute to local industries and economies.

The trend in woodland and grassland conditions under this alternative is projected as stable to declining. However, risk posed to forest products in woodlands and encroached grasslands by stand-replacement fire represents a smaller potential economic loss because the value of fuelwood and the other products that come from woodlands and encroached grasslands are less likely to be affected than sawtimber.

Overall, the risk of stand-replacement fire is reduced as compared to alternatives 1 and 3, as more area on the forest moves to open-canopy conditions. However, it does less to reduce this risk than alternative 2, because it treats fewer overall acres as a result of limiting the use of naturally ignited wildfire.

Alternative 5

This alternative substantially reduces the potential socioeconomic benefit that a suitable timber base can provide. Not because it also recommends 745,286 acres of land to Congress for wilderness designation, but primarily because it restricts regular harvesting activities outside of the WUI in favor of using fire as the primary restoration tool. Only 29,998 acres of suitable timberland occur within the WUI as displayed in table 55 and figure 38. This is followed by table 56, which displays the estimated vegetation management practices for timber types.

Table 55. Timber production suitability classifications for alternative 5

Land Classification Category	Acres
A. Total area within the administrative boundary of the Gila National Forest	3,392,112*
Area within the administrative boundary that are not National Forest System lands (private property or other ownership)	119,972
B. Lands not suited for timber production due to legal or technical reasons	2,589,050
B1. Lands not suited for timber production because it is prohibited.†	822,995
B2. Lands not suited for timber production because the technology to harvest timber without causing irreversible damage is not available.	0
B3. Lands not suited for timber production because there is no reasonable assurance of adequate restocking within 5 years of final regeneration harvest.¥	338,694
B4. Lands not suited for timber production because they are not forested.£	1,427,361
C. Lands that *may* be suited for timber production (A–B)	683,090
D. Total lands suited for timber production because timber production is compatible with the desired conditions and objectives established by the plan (C-E)	29,998
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan¤ (C-D)	653,092
F. Total lands not suited for timber production (B+E)	3,242,142

*Acreages of NFS lands may vary slightly over time due to factors such as resurvey, improved mapping technology and updates to corporate geospatial information systems (GIS) data.

†This includes existing congressionally designated wilderness areas (792,584 acres) and wilderness study areas (27,660 acres), eligible Wild and Scenic River segments with a preliminary classification of Wild (approximately 71,715 acres), and existing designated RNAs (393 acres). In some cases, there is overlap between these kinds of areas. For example, many eligible Wild and Scenic River segments occur within existing designated wilderness. See also Appendix C. Timber Production Suitability, Estimated Vegetation Practices and Projected Harvest Levels Methodology.

¥This includes ecotones, or transition areas between woodland and forest/timberland types. On these moisture limited sites, ponderosa pine establishment and survival under the current climatic regime is episodic and site indices are low. Site indices are a measure of site productivity based on tree height, diameter and age. See also Appendix C. Timber Production Suitability, Estimated Vegetation Practices and Projected Harvest Levels Methodology.

£This includes woodland, grassland, shrubland and riparian Ecological Response Units. See also Appendix C. Timber Production Suitability, Estimated Vegetation Practices and Projected Harvest Levels Methodology.

¤This includes the acres previously identified and discussed under the effects common to all alternatives as being removed for soil and watershed desired conditions and vegetation objectives, as well as those acres of recommended wilderness included in the particular alternative. There may be overlap between areas removed due to incompatibility with desired conditions and objectives and recommended wilderness areas depending on the soils and slopes contained in a given recommended area.

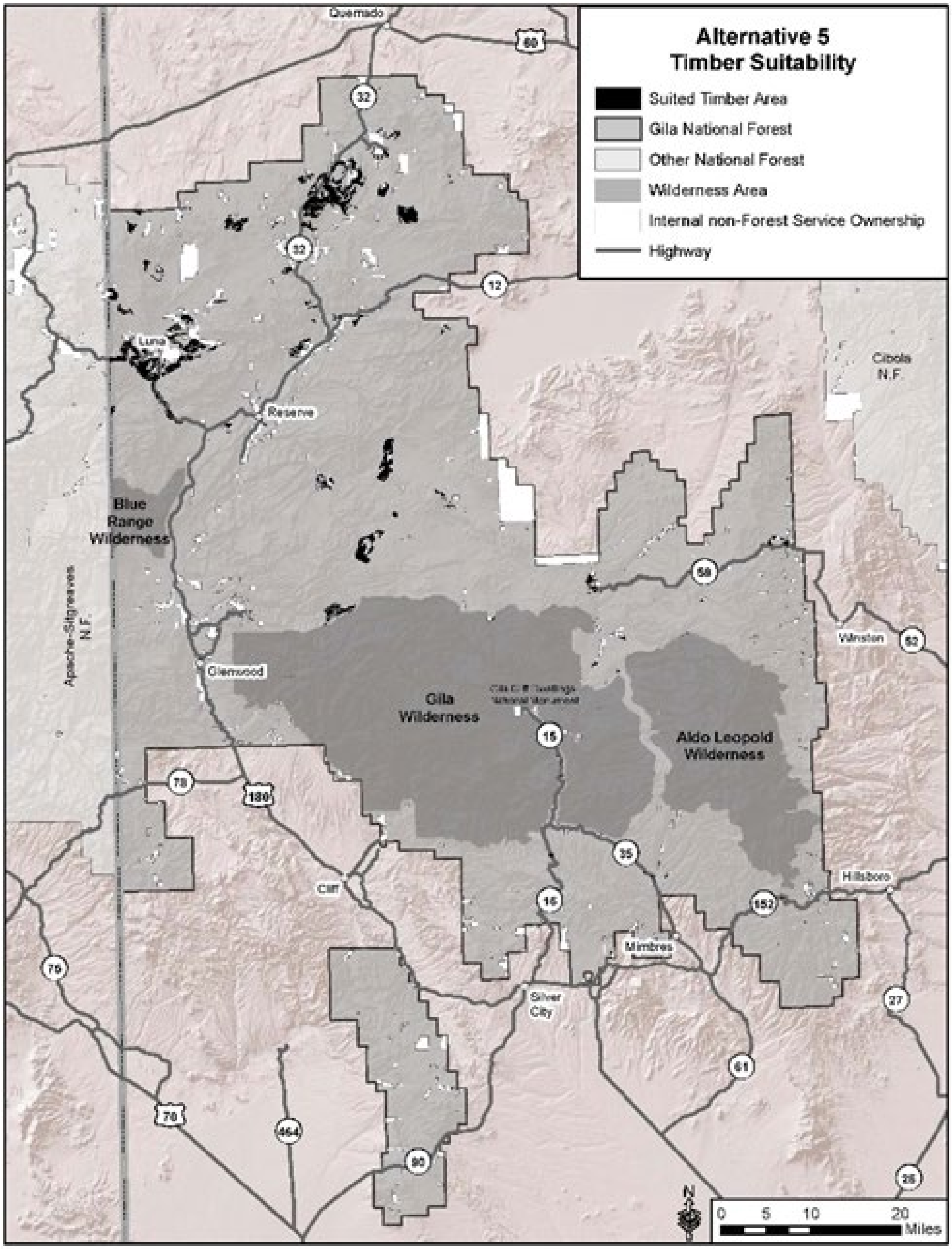

Figure 38. Suitable timber base under alternative 5

Table 56. Estimated forest-wide vegetation management practices in timber vegetation types under alternative 5 (shown in annual average acres per decade)

Forest Cover Types/ Vegetation Management Practices	1st Decade	2nd Decade
Ponderosa Pine Treatments		
Regeneration* (Even-aged harvest)	296	386
Thinning (Even-aged Intermediate harvest)	1,141	1,123
Selection (Uneven-aged harvest)	4,562	4,490
Wet Mixed Conifer Treatments		
Regeneration* (Even-aged harvest)	6	9
Thinning (Even-aged Intermediate harvest)	38	37
Selection (Uneven-aged harvest)	151	149
Dry mixed conifer Treatments		
Regeneration* (Even-aged harvest)	74	0
Thinning (Even-aged Intermediate harvest)	191	206
Selection (Uneven-aged harvest)	763	822
Total Treatments		
Regeneration* (Even-aged harvest)	376	395
Thinning (Even-aged Intermediate harvest)	1,370	1,366
Selection (Uneven-aged harvest)	5,476	5,461

On average 7,222 acres of harvesting activities in timber types, 7,106 acres in woodland and 168 acres of grassland restoration would provide forest products. This represents roughly a 42 percent reduction in acres harvested mechanically as compared to alternative 1. Table 57 shows the PTSQ and PWSQ associated with these treatments in timber and woodland vegetation types. It does not include wood that might be associated with grassland restoration, because those systems are not being managed for a sustainable supply of wood products. Values are rounded to the nearest whole number or decimal place where a whole number would be reported as zero.

While not completely forfeiting the economic benefit forest products can provide, alternative 5 is projected to result in volume decreases that will be detrimental to the local timber and timber-related industries, reducing the forest’s contribution to revenues and job opportunities. As a whole, reduced revenue and job opportunities associated with wood products could lead to a local economic downturn, particularly in the smaller communities surrounding the forest.

Cumulative Effects

Harvesting activities that support restoration and/or fuels objectives are occurring on private lands near or adjacent to the Gila NF, through cooperative efforts between state forestry and private landowners. These activities contribute to the sustainability of local industry. Forest products are also available on the nearby Apache-Sitgreaves and Coronado National Forests, and on lands managed by the BLM. However, distances are generally too large, or access too limited to make harvesting those products economically feasible or justifiable for local residents and businesses. Products being made available by the Gila NF are the dominant socioeconomic driver for the local timber and wood-related industry, and the primary source of fuelwood local residents depend on to heat their homes. Not just because of haul distances, but also because most of the timber vegetation types are located on NFS land.

Table 57. Projected volume associated with estimated vegetation practices under alternative 5

Sustained Yield Limit (SYL)	**583 MMBF, 130 MMCF per decade**					
Timber Products	First Decade			Second Decade		
	MMCF	MMBF	Tons	MMCF	MMBF	Tons
	Volumes other than salvage or sanitation that meet timber product utilization standards					
Lands suitable for timber production						
A1. Sawtimber (industrial softwoods, 9"+)	2	9	28,084	1	7	20,319
A2. Other Products (industrial softwood, 5-9" - roundwood, commonly pulpwood, mostly in the form of fuelwood)	0.3		5,041	0.2		3,025
Lands not suitable for timber production						
B1. Sawtimber (9"+)	2	9	28,084	1	7	20,319
B2. Other Products (5-9")	0.3		5,041	0.2		3,025
C. **Projected Timber Sale Quantity (PTSQ)** (A1+A2+B1+B2)	4	18	66,250	3	14	46,690
Other Estimated Wood Products	Fuelwood, biomass, and other volumes that do not meet timber product utilization standards					
	MMCF		Tons	MMCF		Tons
D1. Non-industrial softwood fuelwood (5"+)	4		1	3		0.8
D2. Hardwood fuelwood (5"+)	0.5		0.2	0.3		0.1
D3. Aspen (5"+)	0.1		0.03	0.05		0.01
E. **Projected Wood Sale Quantity (PWSQ)** (C+D1+D2+D3)	9		66,251	6		46,691

Partnerships with other Federal and state agencies, local governments, private landowners and non-governmental organizations have contributed to accomplishing restoration goals, thereby contributing to the forest product industry. These partnerships are anticipated to increase in importance in the future and new opportunities may be emerging. For example, over the last couple of years, there has been increased interest in commercial fuelwood harvesting. While this type of activity has not been common and there is not enough information to suggest a trend, if the interest continues, more acres could be treated and more products could be made available. Similarly, the creation or expansion of timber-related industry, especially one that could use small-diameter wood (e.g., biomass energy, biochar, etc.), would help the forest management to further reduce overstocked conditions and support a forest products program that sustains social, economic, and ecological systems.

Under the Forest Service's new shared stewardship initiative, all national forests will be striving to work more closely with state forestry to align goals, set priorities and combine mutual skills and assets to achieve cross-jurisdictional outcomes desired by all (USDA FS 2018). This initiative is driven by recent wildfire activity across the Nation and current and predicted climate-driven trends in wildfire activity. New Mexico State Forestry has already identified the state's priority areas based on development potential, susceptibility to insects and disease outbreaks, wildfire risk and enhancement of public benefit from natural resources. The Gila NF contains areas ranging from low to high priority for the state (EMNRD Forestry Division 2010), so there is already a good measure of alignment and potential for future collaborative efforts. While the new state forester and staff are currently working on updating the state action plan, relationships between New Mexico State Forestry and the Forest Service are such that the current degree of alignment is expected to be maintained or even improved.

The 2018 Farm Bill gave the Forest Service and the BLM permanent authority for Good Neighbor and expands it to all states and Puerto Rico to enter into cooperative agreements or contracts to allow the states to perform watershed restoration and forest management services on NFS land. The Gila NF was the first national forest in the state of New Mexico to use the Good Neighbor Authority. More use of the Good Neighbor Authority in the southwestern part of the state would be beneficial for accomplishing needed watershed restoration and forest management, and encouraging collaborative partnerships. A number of projects are ready to be implemented, but funding is often lacking or difficult to transfer to the project.

However, even with collaboration and partnerships, resources are not without limits and competition for limited funding is strong. There are likely many acres in the Gila NF, and across the Southwest, that could be treated, but will remain untreated simply because the majority of partner dollars are being invested in municipal watersheds and on lands adjacent larger population centers. Many scientific predictions of widespread tree mortality have been made due to drought and climate-driven insect or disease epidemics or stand-replacement fire. Widespread regeneration failure has also been predicted, which could alter the availability of forest products over the long term. While these predictions may or may not be realized within the life of the plan, the actions taken within the life of the plan will likely influence how change affects the Gila NF, the sustainability of the forest products it currently has to offer, and their associated economic benefits.

Herbicide-Use Environmental Consequences

The following discussion of environmental consequences addresses the effects of the herbicide-use alternatives on sustainable forestry. The effects of these proposals on human health is addressed under the social and economic heading.

Analysis Methodology

This is a qualitative analysis supported by the available published literature as cited in the text.

Effects Common to All Herbicide-Use Alternatives

All of the alternatives authorize the use of some herbicides on some number of noxious weeds. Through their potential effects to soil, vegetation communities and fire regimes, noxious plant infestations can change the land's ability to produce wood products. For example, false brome, designated as a noxious weed by the Oregon State Department of Agriculture, can displace native understory plants, suppress regeneration of tree species and alter fire regimes (Chornesky et al. 2005) such that conversion from a tree-dominated ecosystem to a grassland could be an outcome. While the species and populations known to exist in the Gila NF are not substantially reducing productivity or threatening sustainable forestry, this could change in the future. Herbicides are in many cases, the only effective treatment for noxious weed species, and thereby, the only way to sustain the productivity of forests and woodlands.

Effects of Herbicide-Use Alternative A-No Action

Alternative A allows all noxious weed species on the New Mexico Department of Agriculture's noxious weed list as it existed in 2000, with the addition of tree of heaven, to be manually pulled or cut with a chainsaw and/or treated with herbicide. Fourteen different herbicides, all with Forest Service risk assessments, are approved for use, and all methods except aerial application are allowable. No new noxious weeds added by NMDA to the noxious weed list after 2000 are authorized for treatment and no native plant species may be targeted.

However, it does not fully support EDRR or the maintenance of vegetation communities dominated by native species. When new noxious species designated by NMDA and/or are introduced and/or discovered, time is usually of the essence. The longer noxious weed populations are allowed to persist on the landscape, the greater the risk of spread and the more area that may potentially need treatment. If discovered and treated early, eradication is more likely. If delayed, control or containment may be the only realistic goals, depending on the particular noxious species. This alternative does not facilitate rapid response to emerging threats and compromises management's ability to maintain the ecological and economic sustainability of the forest products industry in the forest.

Effects Common to All Herbicide-Use Action Alternatives

Alternatives B, C, and D authorize manual removal and herbicide treatments on all noxious weed species listed on the most current APHIS, NMDA, or other state department of agriculture noxious weed lists. Any noxious plant species added to any of these lists after this NEPA decision would be automatically authorized for treatment. Noxious species could be introduced from most places in the United States, and while the climate in the Gila NF may not be conducive to some noxious species now, it may be in the future. Waiting for state listing to authorize their treatment could limit EDRR, and therefore, these alternatives support are more likely to support a successful EDRR program, promote maintenance of adequate vegetative cover and native diversity to protect soil functions, and promote movement toward and maintenance of desired conditions.

These alternatives also authorize the use of any herbicide with both an EPA and Forest Service risk assessment. As previously described under the same heading in the upland vegetation, fire ecology and fuels analysis, this does not change the potential detrimental effects anticipated as a result, but it does have potential beneficial effects as new herbicides with lower levels of risk could be registered in the future.

Effects of Herbicide-Use Alternative B-Proposed Action

Alternative B would also authorize the use of herbicide to control the density of native alligator juniper and evergreen oak species in order to accelerate progress toward desired conditions for vegetation communities and the WUI. In forested/timberland type vegetation communities, increases in the density of these species after harvest may interfere with the regeneration and growth of higher value timber tree species and place the stand in danger of loss to fire. There is less economic benefit to the local forest products industry when the forest has to invest in retreatment of the same acres to address the lower value understory species.

Authorizing herbicide to help change the trajectory of these areas toward desired conditions for vegetation would benefit local industry by favoring the reproduction and growth of higher value species and reducing the potential for structural changes that increase the likelihood of fire losses.

Effects of Herbicide-Use Alternative C

The effects specific to alternative C would be similar to the proposed action without treatment for woody native oak and alligator juniper. This alternative includes utilizing the current noxious weed lists, EDRR, and EPA and Forest Service risk assessments. This would quickly address any new noxious species infestations or new herbicides that have undergone risk assessments.

Effects of Herbicide-Use Alternative D

The effects specific to alternative D are similar to those of alternative B. However, the use of herbicide would only be restricted to the WUI, substantially reducing the benefits described for alternative B.

Cumulative Effects

The cumulative effects described for upland vegetation, fire ecology and fuels, and soils and watersheds are relevant to timber, forest and botanical products in that the trajectory toward desired conditions for ecosystems and watersheds supports a sustainable and diverse supply of products.

Livestock Grazing

Affected Environment

Livestock grazing is a traditional use of the forest that precedes establishment of the national forests and grasslands. It is important to the cultural identity of local communities and to socioeconomic sustainability. This use has changed dramatically over the last 70 years. Prior to 1930, substantially more livestock were permitted to graze in the Gila NF than today, and there were many more ranchers with permits, in part because allotments were smaller so more permits were available. The amount of permitted livestock use and number of allotments were reduced to bring grazing in-line with the capacity of the landscape to support it over the long term.

The Spanish introduced livestock grazing in the Southwest in the late 16th century, which included cattle, horses, goats, and sheep. Pueblos and Spanish-American villages practiced yearlong grazing in the tradition of open range for several hundred years. By the early 1800s, Spanish-Americans had developed large cattle herds in New Mexico. After 1870, the cattle industry expanded. It is estimated that on New Mexico rangelands there were 158,000 cattle in 1870, and 1,065,000 in 1886. Range conditions deteriorated and following the drought of 1886, thousands of cattle starved. This drought, range deterioration, and competition for grazing lands brought about the fencing of private rangelands. Open-range grazing ended on all but Federal lands (Baker et al. 1988 IN USDA FS Gila NF 2017).

A 1905 USGS report included a description of range conditions across the Gila. In the vicinity of the T Bar Grasslands, the report documents the grazing of sheep had produced “a barren desert, not a blade of grass to be seen and even the roots being entirely destroyed.” Conditions were similar, “but not so bad” over much of the forest. The area around the East Fork Gila River and the Black Mountains was an exception, which Rixon described as having “a fine growth of grass” (Rixon 1905).

Based on decadal averages, from 1910 to 1960, livestock grazing in the Gila NF was reduced by 64 percent. Sheep and goat numbers began to decline and no longer grazed the forest after the 1970s, although most of these animals were taken off long before. As part of the elk reintroduction effort in the 1950s, the New Mexico Department of Game and Fish (NMDGF) acquired the Heart Bar Ranch and the permit for the Glen Allotment, which encompassed the vast majority of the Gila Wilderness. This portion of the Gila Wilderness has been unalloted since, with no permitted or authorized livestock. The Glen Allotment is likely no longer economically viable due to the financial investment that would be required to get range infrastructure into a functional condition.

The Wilderness Act of 1964 directs that livestock grazing should continue where it occurred prior to designation. Congressional grazing guidelines [House Committee on Interior and Insular Affairs Reports (95-620 and 95-1821)] provide that grazing shall not be curtailed or phased out simply because the area is, or has been designated as wilderness. Adjustments to permitted livestock grazing in wilderness should give consideration to legal mandates, range condition, and protection of range resource deterioration.

Today, livestock grazing activities on the Gila NF support 612 jobs and contribute $11.4 million in labor income on an average annual basis (see Social and Economic Conditions). While the economic benefit may seem small to some, it is essential to the families it supports. So much so that many work other jobs outside the ranch as a means of supplementing their income and maintaining the viability of their operation. As of 2018, the Gila NF contained 129 allotments. One hundred and sixteen of these allotments are active with current permits, 10 are active but currently vacant, and 3 have been closed by NEPA decision. Livestock use on vacant allotments may be authorized to a current permit holder in good standing on a temporary basis. For example, before or after a prescribed fire, or during and after a wildfire. Grazing can be reauthorized on vacant allotments at any time with an allotment-specific environmental analysis.

Permitted and authorized use between the years of 2012 and 2018 are shown in the following graph using animal unit months as units of measure. While records extend beyond this time frame, the 2012 to 2018 period of record was chosen because of shortcomings in the agency's database that require more processing to get accurate values out of older data. An animal unit month is the quantity of forage required by one mature cow and her calf for one month, or the equivalent in sheep or horses. Permitted use is the upper limit generally allowed by the allotment's NEPA decision. Authorized use may be less than or temporarily slightly more than permitted use, depending on annual variability in forage and water availability[ff].

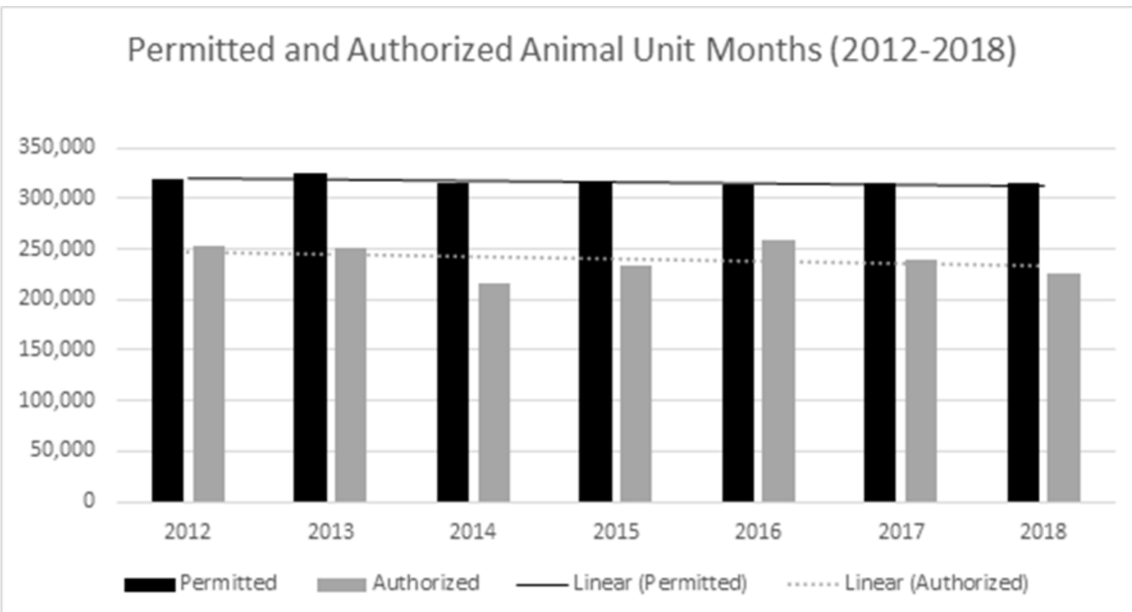

Figure 39. Current trends in permitted and authorized use in the Gila NF, including the portion of the Apache National Forest administered by the Gila NF

Despite the fact that there is no longer a substantial downward trend in permitted use (figure 39), the Gila NF range program and its permittees continue to face change. Maintaining range infrastructure is an expense borne primarily by the permittee—and it is expensive. Fire-damaged infrastructure has become a major challenge for some, but not all permittees. This is a challenge not just for the permittee and the range program, but also for the social acceptance of restoring the natural role of fire to the landscape in communities that depend on ranching.

Pasture rotations are an important adaptive management tool that builds flexibility into grazing systems. In some areas on the northern portion of the forest, seasonal use of forage by elk can become significant in localized areas during certain periods of the year. Competition for forage between livestock and elk is an ongoing concern for livestock producers within the plan area (USDA FS Gila NF 2017). However, recent annual end of growing season utilization monitoring in these areas

[ff] This allowable temporary increase is usually limited to no more than 10 animals.

indicates that utilization standards are not being exceeded by elk or livestock. Conflicts with other wildlife, notably the Mexican gray wolf, have also created issues for some permittees.

Drought has always been a factor, and is likely to increase in frequency, severity, and duration. Some have concluded that this kind of change in the Southwest could be a benefit to livestock producers, as forest and woodland vegetation are expected to decline and grassland and shrubland vegetation are expected to increase (McDowell et al. 2015; Parks et al. 2018a; among others). However, others have concluded that especially in the Southwest, livestock production will be negatively impacted due to increased diseases and heat stress, decreased water availability, lower nutritional content in some forage species and lower overall productivity (Rojas-Downing et al. 2017). Although uncertainty remains about these predictions and their socioeconomic impacts (Hand et al. 2018), livestock grazing in the Gila NF will continue under an adaptive management framework, and retain its cultural and socioeconomic importance to local communities for the foreseeable future.

The adaptive management framework recognizes that knowledge about natural systems can be uncertain, and that future management will need to have flexibility to respond to changing conditions. Adaptive management practices are based on clearly identified desired conditions and monitoring to determine if those practices are producing movement toward or achievement of those desired conditions; and, if not, to facilitate management changes that will promote movement toward, and achievement of desired conditions. This allows management flexibility within the legally required National Environmental Policy Act (NEPA) decision such as increases or decreases in livestock numbers, or changes in season or length of use. Desired conditions defined at the allotment level must be consistent with the desired conditions and other direction found in the forest plan that is current at the time. Adaptive management decisions are a large driver of the observed fluctuations in authorized use (figure 39).

When implemented as designed, adaptive range management can provide for cultural, social and economic benefits while supporting natural processes, biodiversity, soil and watershed function, and wildlife habitat. Range and other resource conditions have improved over the last twenty years under the adaptive management framework; however, more forage production remains a desired condition. While there is certainly an inverse relationship between understory herbaceous cover and degree of overstory canopy closure, higher densities of woody vegetation are not the sole reason forage productivity remains below desired levels. Soil properties and functional status, temperature and precipitation patterns, herbivory and fire all interact to influence the outcomes of plant competition and the relative dominance of either woody or herbaceous species. Unfortunately, woody vegetation densities have increased because of these interactions across the Gila NF and many rangelands need restoration (USDA FS Gila NF 2017).

Plan-Level Environmental Consequences

The following discussion of environmental consequences addresses the effects of the alternatives on livestock grazing as a use of the forest. It does not discuss the effects of livestock grazing on natural resources or other resource uses. Those discussions are housed under their respective topic headings.

Analysis Methodology

This analysis includes the following general assumptions:

- Adaptive management includes appropriate site-specific, allotment scaled monitoring.
- Unauthorized and excess use will be incidental to non-existent.

- Invasive species are absent or if present, occur at levels that do not substantially impair the productivity of the land.
- The Congressional Grazing Guidelines for Wilderness will be applied to WSAs and congressionally designated wilderness. These guidelines include direction to consider, on a case-by-case basis, allowing occasional motorized access where practical alternatives do not exist for the purposes of maintaining or constructing range infrastructure where livestock grazing is a pre-existing use prior to wilderness designation.

The degree to which each of the alternatives provides for movement toward the desired conditions for a sustainable grazing program and contributions to local communities is measured by projected changes in range condition, animal unit months, and management flexibility.

Range Condition

Range condition is an assessment of rangeland health. Range condition assessments compare existing soil and vegetative conditions as it relates to the ecological potential of the site, and its value for livestock grazing. When a site is healthy, it is more productive and resilient to disturbances such as drought and fire. There are several methodologies to assess soil and vegetative conditions. In the past, the Parker 3-step methodology was the standard, which includes an assessment of groundcover and plant community composition, density, and vigor. A condition category and observed, or apparent trend was then subjectively assessed for both vegetation and soil stability. While new protocols that better consider soil quality and ecological health have been developed and will likely be adopted in the future, a few of the Parker 3-step concepts are useful for this environmental analysis.

Woody species below a certain size are considered undesirable “invaders” by the Parker 3-step method, and their presence effects both condition and trend determinations. Because the state-and-transition models that were used to analyze vegetation condition and trend for plan alternatives are only able to capture changes in woody vegetation, not herbaceous vegetation, this is the only component of range condition that can be analyzed quantitatively. The models, including important assumptions and limitations are discussed in the upland vegetation, fire ecology and fuels analysis with additional information about how Gila NF staff developed model inputs provided in Appendix B: State-and-Transition Modeling Process. Soil functions and conditions are analyzed qualitatively and supported by the analysis under the soil heading.

Animal Unit Months

Estimations of any changes in AUMs that could occur as a result of implementing each alternative is required for the socioeconomic analysis, and for internal agency and department briefings the forest supervisor must provide. The estimated percent change in AUMs was calculated, based on the vegetation models described previously, using the estimated percent reduction in canopy cover across the forest at the end of the first decade. Spruce-Fir Forest, Mixed Conifer with Aspen, and Mountain Mahogany Mixed Shrubland were not included in the calculations. The first two vegetation types contribute in a relatively small way to livestock grazing. The shrubland is important to livestock grazing, but the dynamics are different. Browse availability is a matter of both total woody cover and shrub height. The way vegetation conditions are described in this particular model includes all height classes in each canopy cover class, which does not facilitate a quantitative estimation of potential changes in AUMs.

Estimation of the percent reduction in canopy cover required a series of calculations and assumptions. In the vegetation models, canopy cover is described as being open or closed. Open canopy conditions are classified as being 0 to 29.9 percent canopy cover. Closed canopy is described in two classes, 30 to 59.9 percent and 60 percent or greater. The most common closed-canopy cover class in the forest is 30 to 59.9 percent. It is assumed that forage production under open canopies is not limited by woody species, but forage production is limited by woody species under closed-canopy conditions.

The first step in estimating a percent reduction in canopy cover was to calculate the proportional net change in the area under closed canopy between current conditions and the model projections at the end of the first decade. The next step required two assumptions. The first assumption is that the difference between the midpoint of the open-canopy cover class and the 30 to 59.9 percent closed-canopy cover class approximates the average canopy cover change when an area moves between open and closed canopy state. This would mean a 30 percent reduction or increase in tree canopy cover (45 percent minus 15 percent = 30 percent). However, this does not necessarily equate to a 30 percent change in forage production, because grasses and other palatable forage species often grow under at least part but sometimes all of a tree canopy. This necessitated another assumption, which is that on average, half of the area under tree cover is occupied by forage species and half is not. This would mean that a 30 percent reduction in tree cover could be expected to result in a 15 percent increase in forage production. In reality, increases in forage production between existing and post-treatment conditions vary greatly, depending on a variety of factors including natural soil productivity, temperature, and precipitation patterns, and tree canopy height to name a few. There is also a lag time between completion of the treatment and establishment and growth of new grass plants, which is the reason the 10-year modeling results were used to reflect anticipated changes over the life of the alternative ultimately selected.

The final step in the calculation was then to multiply the proportional net change in the area under closed-canopy conditions at the end of the first decade by 15 percent. For each alternative, the resultant value was used to establish the high end of what was intended to be a conservative range.

A zero value was used to establish the other end of the range of possible changes in AUMs. This was done to account for the variables that influence carrying capacity and condition of the range that are outside the influence of plan direction under any alternative. These variables include allotment-specific adaptive management strategies, patterns of precipitation and temperature, soil productivity potential, and wildlife populations and patterns of use. It may be that any increase or decrease in AUMs that are projected in this analysis could be offset by a series of dry or wet years, or changes in any other of the variables mentioned.

Management Flexibility

Management flexibility is necessary for adaptive management to work. The degree to which each alternative affects management flexibility is analyzed qualitatively. It considers range infrastructure condition, modes of access and travel, and the use of mechanized equipment.

Range infrastructure includes fences, cattle guards, water tanks, troughs and pipelines, corrals and other holding facilities. When it is in good condition, the full suite of adaptive management strategies are possible. When it is not, the success of some strategies may be reduced or may be impossible to implement. Modes of access and travel, and the use of mechanized equipment can influence producer's profit margins and subsequent contributions to the local economy. Recent cost estimates obtained by the forest provide basis for understanding the economic costs of fencing both outside and within areas that cannot be accessed or cleared by mechanized means. With mechanized access and other equipment, a mile of fencing can be reasonably expected to cost $17,477. Without it, the cost should be expected to increase to $29,410.

Effects Common to All Alternatives

All alternatives would continue to provide forage for domestic livestock and opportunities for ranching lifestyles consistent with the desired conditions for other resources and resource uses, the agency's multiple-use sustained-yield mandate and other applicable laws and regulations. Maintaining consistency with the desired conditions for other resources and resource uses could include periodic adjustments in grazing intensity, season or duration of use, type of grazing system. It could also potentially include other management practices such as changing pasture rotations, reconfiguring pasture divisions or investments in water developments. These adjustments may not be convenient and may even have short-term economic costs. These short-term costs could include temporary reductions in economic contributions as a result of running fewer numbers or higher expenditures for range infrastructure. However, as several grazing permittees have commented during the plan revision process, taking care of the land and its resources is in the producer's long-term best interest (USDA-FS Gila NF 2016). Movement toward, achievement and maintenance of the desired conditions for ecosystems and watersheds sustains livelihoods and sustains a long-term economic benefit to local economies. Ecosystems and watersheds in good condition produce more forage, which increases opportunities for economic gain. Furthermore, when drought and other disturbances temporarily reduce forage production, the magnitude and duration of those reductions are smaller and shorter. Less fluctuation in forage ability creates greater economic stability for local communities.

All alternatives include direction to maintain or improve range condition and manage for forage quality. Given this, grazing management in all alternatives would balance use with the capacity of the land to support it using an adaptive management approach to deal with fluctuations in available forage and water due to weather and other factors. Improved range condition would increase the productivity and resiliency of the land, and opportunities for economic gains. Conversely, declines in range condition would reduce the productivity and resiliency of the land, and thereby, the opportunities for economic gain.

In terms of access and travel, allotment management will continue to be influenced by travel management and existing designations such as RNAs, WSAs and congressionally designated wilderness under all alternatives. All alternatives are consistent with the Travel Management Rule. Under any of the alternatives, permittees would continue to follow stipulations in their permit regarding cross-country motorized travel and use of administrative roads to access their allotment and infrastructure. Existing designated areas will continue to pose limitations on modes of access and the use of mechanized equipment for infrastructure maintenance, consistent with the legislation or policy direction that establishes those designations.

All alternatives include the Gila River designated Research Natural Area (402 acres), the congressionally designated Hell Hole and Lower San Francisco WSAs (18,860 and 8,800 acres, respectively), and the congressionally designated Blue Range, Gila and Aldo Leopold Wildernesses (29,099 acres, 559,688 acres, and 203,797 acres, respectively). Livestock grazing is generally not consistent with the management of RNAs, and is specifically inconsistent with the establishment of the Gila River RNA. Given that this removes only 402 acres from livestock grazing and does not pose any artificial limitation on access to the surrounding rangelands, there is no reduction in the ability of the forest to contribute grazing related revenue to local economies, nor are there decreases in flexibility. Similarly, despite the differences between the alternatives in terms of proposals for additional RNAs, none would pose limitations on access to surrounding rangelands and the number of acres are small. There is no substantial difference in the forest's ability to contribute to local economies as a result of any of these proposals (see appendix H).

Livestock grazing is consistent with direction for managing existing congressionally designated WSAs and wilderness areas, but there are limitations imposed on modes of access and the use of motorized equipment, which can add time, labor and cost. This means there is less economic return on the investment made in range management, which reduces the economic contributions these areas can provide. Public motorized access and use of mechanized equipment is prohibited in these areas. However, in designated wilderness, Congress established guidelines for grazing permittees to obtain permission for occasional use of motorized equipment, on a case-by-case basis, where motorized access for range management was permitted prior to designation. District rangers or forest supervisors may authorize such use in the grazing permit for the maintenance, reconstruction or construction of range infrastructure necessary for effective management based on a rule of practical necessity and reasonableness. Such use must also not have a “significant adverse impact” on the natural environment. Following these guidelines may mitigate some, but certainly not all of the added time, labor, and cost associated with managing livestock grazing in designated wilderness.

While alternatives 2 through 5 all contain new areas recommended to Congress for potential wilderness designation, proposed plan direction under these alternatives would allow motorized access and the use of mechanized equipment to continue for the purposes of range management until such time Congress sees fit to evaluate whether to designated or release them. Therefore, there is no effect to the current economic contribution these areas make to local economies as a result of the recommendation. However, there would be effects should Congress see fit to actually establish the designation, leading to differences among alternatives. These effects are dependent on what lands are recommended, how much land is recommended, whether or not the terrain limits or requires mechanized access or equipment for allotment management or vegetation treatments, and whether or not mechanical vegetation treatments are likely to be economically feasible or ecologically necessary.

All alternatives contain some level of mechanical harvesting, prescribed fire and the use of natural ignitions under conditions that are likely to support movement toward, attainment and maintenance of desired conditions, including range condition. While any increase in available forage would be a long-term economic benefit to producers, it may come at a short-term cost or inconvenience. Adjustments to grazing management may be needed in order to realize increased production and AUMs as grass plants need time to establish or recover. Under all alternatives, plan direction includes provisions for this to be evaluated by the permittee and interdisciplinary staff members of the Gila NF, on a case-by-case basis. Differences in projected changes in AUMs vary among the alternatives due to the vegetation types targeted, number of acres treated, and preferred methods of treatment. Methods of treatment matter because they have different costs per acre.

The Gila NF is a frequent-fire landscape. Naturally ignited wildfire will continue to occur under all alternatives. Any wildfire will consume forage and has the potential to damage or destroy range infrastructure. Erosional events and altered patterns of water flow can result from high-severity fire, which may lead to stock ponds filling up with sediment or being breached, and reduced water availability for livestock. All of these things can be inconvenient and increase costs for grazing permittees associated with repair or reconstruction of infrastructure, but may not always reduce the economic contribution to local economies. That depends on where supplies are purchased, and if a contractor is hired, whether or not the contractor resides in the local community. It also depends on the extent to which range infrastructure is damaged on a single allotment and how often. If it is of sufficient extent or frequency, the ability of a particular individual permittee to absorb those costs and maintain an economically viable operation may be compromised. Differences among alternatives are associated with the extent to which vegetation treatments are likely to promote low-intensity surface fires and reduce the risk of high-intensity fire.

In relation to water-related range infrastructure and management flexibility, riparian and aquatic ecosystem direction under all alternatives requires these systems be given preferential consideration in the management of all resources uses. The desired conditions is for these areas to be in, or trending toward proper functioning condition. Riparian areas in this condition are better able to provide benefits to people, as discussed in the riparian and aquatic ecosystems analysis. What management action are necessary to provide preferential consideration are left to be determined by site-specific circumstances. Furthermore, there is no objective for riparian exclosures under any alternative. Exclosures can be one of several effective management strategies to help movedegraded riparian areas toward proper functioning condition, but they are not necessary in every case. When and where an exclosure is determined appropriate, all action alternatives require the design to include an alternative watering point for livestock. That the no-action alternative does not specifically spell this out does not contribute to differences between alternatives, as this practice is not only consistent with New Mexico state water law, it is consistent with the agency's mission to provide for sustainable use, and reflective of the value that forest management places on traditional uses. The plan direction providing consideration to riparian and aquatic ecosystems preserves the existing management flexibility to address any resource concerns that may arise in the future on a case-by-case basis. Any additional economic costs that may be placed on a permittee associated with construction and maintenance of riparian exclosures, and the degree to which the agency can absorb some of those costs, would continue to be dependent on the circumstances of each individual situation. Therefore, how this may affect the return on investments and contributions to local economies is a matter of speculation.

All alternatives contain requirements for livestock water developments to include wildlife access and escape considerations, either as a standard or a guideline. Whether a standard or a guideline, this is required and the language is general enough in both cases that there is no actual difference in the flexibility permitted. How that consideration is best provided can be designed at the project level. Providing for wildlife escape considerations potentially reduces inconvenience and maintenance costs associated with preventing water from being fouled by wildlife that can't get out and drown.

Effects Common to Alternatives 2, 3, 4, and 5

None of the action alternatives proposes additional acres for the RNA system. Instead, all action alternatives retract two potential RNAs totaling 444 acres that were proposed during the last planning cycle. The proposals for the Largo and Agua Fria RNAs were retracted because they were found ineligible for the designation (see Appendix H: RNA evaluation process). The future status of the remaining existing proposed RNAs vary among these alternatives.

Effects Common to Alternatives 1, 2, and 5

These alternatives retain the existing proposed Turkey Creek (1,200 acres) and Rabbit Trap (300 acres) RNAs. Given Rabbit Trap's small acreage and the surrounding landscape, it does not represent a significant number of potential AUMs, nor does it impose a significant limitation on management flexibility. Turkey Creek is partially located in a closed allotment (Watson), with the remainder being located in Gila Wilderness in the former Glenn Allotment, which is now unallotted (see Affected Environment). Modes of access and travel, and the use of mechanized equipment is already restricted by terrain and the fact it is located almost entirely within the designated Gila Wilderness. Therefore, there is no substantial reduction in the return on investment, current levels of flexibility, or the sustainability of livestock grazing as a use of the forest. Neither is there measurable change in the economic contributions the Gila NF can make to local communities as a result of these proposals.

Effects Common to Alternatives 2, 3, and 4

Related to management flexibility, these alternatives recommend acres to Congress for consideration as designated wilderness. These areas are identified in Appendix F: Wilderness Process. If designation were to happen in the future, the flexibility that all alternatives provide in terms of motorized access and travel and the use of mechanized equipment in recommended wilderness would be reduced. However, the majority of these areas are currently accessed, traveled and maintained by non-mechanized means and are unlikely to become a priority for mechanical harvesting treatments due to steep and rugged terrain (see also upland vegetation, fire ecology and fuels). Certainly, some increased operation and maintenance costs and reduced profit margins could be incurred by individual permittees because of the prohibition on mechanized equipment[gg]; however, the nature of the process used to arrive at these recommendations was such that those increased costs would not occur to the extent that it could be reasonably expected to reduce the viability of any one operation, or substantially reduce the contribution to local economies that livestock grazing on the forest generates. Specifically, the criteria for recommended wilderness under this alternative examined water sources, range fence, and other range developments that require frequent maintenance or access by motorized mean and adjusted boundaries to allow exclusion of these management concerns. The economic contributions provided through livestock grazing in the Gila NF are not likely to be substantially different from alternative 1.

Effects Common to Alternatives 2 and 5

Both alternatives 2 and 5 include fire as treatment methods, with a stronger emphasis on prescribed and naturally ignited wildfire than alternative 1. Restoring fire to the landscape provides opportunities to improve forage production, and address tree densities and encroachment. More acres can be treated overall with fire treatment methods under these alternatives, but can also lead to range infrastructure damage and costs to the affected permittees. There are many unknowns in how the trade-offs between improved range condition and potential increases in AUMs and infrastructure damage might play out economically, both for the permittee and for the local economy. There is a management approach within the draft revised plan that when range infrastructure is damaged as a direct result of any suppression action from any wildland fire, the incident management team and forest personnel identify qualifying needs for immediate repair or reconstruction and prepare a plan, and if approved, the plan is implemented under the fire's funding mechanism. Applying this management approach improves relationships, builds support for restoring fire to the landscape, and helps maintain the forest's ability to support existing multiple uses. Although not all incident-related damage qualifies for emergency funding, and the amount of fire used as a restoration tool under some alternatives may overwhelm the forest capacity in terms of both funding and staff time to keep up with the requests for range infrastructure repair. It should be noted that under alternatives that limit the use of fire, the risk of infrastructure damage due to undesirable wildfire effects is likely to increase as more of the forest moves toward closed-canopy conditions.

Effects Common to Alternatives 3 and 4

These two alternatives do not retain the existing proposed Turkey Creek and Rabbit Trap RNAs, but the effects are similar to the alternatives because of the characteristic of these areas identified in the previous discussion for alternatives 1, 2 and 5. There is no substantial reduction in the return on investment, current levels of flexibility, or the sustainability of livestock grazing as a use of the forest.

[gg] With mechanized access and other equipment, a mile of fencing can be reasonably expected to cost $17,477 dollars. Without it, the cost should be expected to increase to $29,410 dollars.

Neither is there measurable change in the economic contributions the Gila NF can make to local communities.

Under these alternatives, management would prioritize stocking vacant allotments to the maximum extent possible. For existing vacant allotments or allotment term grazing permits that are waived back to the Forest Service in the future without a preferred applicant, the line officer would determine the sufficiency of the existing environmental analysis and decision and USFWS consultation requirements prior to reissuance of a new term grazing permit through the grant process. Under these alternatives, the line officer would exercise the authority to authorize use of a vacant allotment by an existing term grazing permit holder on an annual basis. This can be authorized through an existing term grazing permit annual operating instructions and must be in compliance with USFWS consultation.

This could increase the ability of the forest to contribute related socioeconomic benefits to local communities, proportional to the capability and capacity of the particular allotment, including the condition of its infrastructure and the range. On the other hand, if all vacant allotments are quickly stocked to the maximum extent possible, this could result in a loss of flexibility during drought years, before or after fire, or under other circumstances which result in some or all of a permitted allotment becoming temporarily unusable with fewer options of where to allow the livestock to graze in the forest. If there were no legal places for these displaced livestock to graze in the forest, the permittee may have to find another lease somewhere else (e.g., private property, State, or BLM), which would involve additional financial burdens, hauling of stock/feed, and social anxiety due to economic insecurity.

Alternative 1 – No Action

The assessment report found trends in range condition were generally stable to upward under current management based on recent allotment-level environmental analyses. The assessment report also found tree densities continuing to increase in all the vegetation types important to livestock grazing and determined that risks to the sustainability of forage production existed because of this (USDA FS Gila NF 2017). Given this information, the approximation of a forest-wide trend in range condition is taken to represent soil stability, herbaceous community composition, density and vigor. This stable to upward trend in these components of range condition assumed to continue under this alternative.

Given number of acres that can be treated under this alternative, tree densities are projected to continue increasing, leading to a decline in range condition due to woody invaders. A corresponding decline in AUMs of up to 8 percent is anticipated to result. This would reduce the forest's ability to contribute to the local economy. On the other hand, favorable weather conditions could increase herbaceous productivity and sustain current AUMs and contributions to the local economy. Conversely, unfavorable weather conditions could exacerbate any declines. Aside from AUMs, the risk of infrastructure damage due to undesirable wildfire effects is likely to increase as more of the forest moves toward more closed-canopy conditions. No additional areas are recommended to Congress for wilderness designation under this alternative, so there are no associated effects. There are also no provisions for treating vacant allotments. The status and use of vacant allotments has been and would continue to be determined on a case-by-case basis within the existing regulatory and policy framework and interested applicants. This makes the availability of those allotments to provide for flexibility during times of drought, fire or wildlife conflict a matter of happenstance. This does nothing to promote economic stability given projected long-term trends in drought cycles and wildfire seasons.

Alternative 2 – Proposed Action

This alternative uses both mechanical harvesting and fire as treatment methods, with a stronger emphasis on prescribed and naturally ignited wildfire than alternative 1. Due to this increased emphasis, more acres can be treated, overall. This alternative also allows for slightly more mixed-severity fire, which is more effective in reducing tree densities than low-severity fire. Subsequently, a decrease in closed-canopy conditions is projected. Range condition is expected to improve slightly as compared to alternative 1 with a maximum projected increase in AUMs of 2 percent. However, whether or not this improvement in range condition or increase in AUMs is actualized will also depend on weather patterns, natural soil productivity, site-specific adaptive management strategies, wildlife populations and patterns of use.

The reduction in closed-canopy conditions will also reduce the risk of infrastructure damage due to high-severity wildfire. However, with an increased emphasis on fire as a management tool and more mixed-severity acres there is a greater likelihood of infrastructure damage. This will result in decreased flexibility and increased costs for the affected permittees, but the cascading effects on the local economies may be positive or negative depending on if the resources acquired and labor needed to repair range infrastructure is locally sourced or not. Given the current economic difficulties associated with repairing and reconstructing fire-damaged range infrastructure, the benefits of improved ranged condition and increases in AUMs are unlikely to balance the trade-offs. Some reduction in management flexibility and returns on investment are anticipated as a result of implementing this alternative.

This alternative also adds a measure of flexibility as it considers retaining vacant allotments in that status, on a case-by-case basis, with the agency becoming responsible for infrastructure maintenance. The purpose of retaining vacant allotments in that status is to provide an alternative source of forage for current permit holders during drought years, before or after fire, and under other circumstances, which might render a portion or all of a permitted allotment unusable. While this may reduce the overall socioeconomic contribution the forest can provide through livestock grazing, it could provide more security for current permit holders and reduce economic fluctuations in the local economy. The added management flexibility allows forest management to get to desired conditions for grasslands and other vegetation types that have more of an herbaceous understory faster, which results in long-term stability to the permittee and local economy.

Also related to management flexibility, this alternative recommends approximately 110,402 acres to Congress for consideration as designated wilderness. These areas are identified in Appendix F: Wilderness Process. If designation were to happen in the future, the flexibility that all alternatives provide in terms of motorized access and travel and the use of mechanized equipment in recommended wilderness would be reduced. However, the majority of these areas are currently accessed, traveled and maintained by non-mechanized means and are unlikely to become a priority for mechanical harvesting treatments due to steep and rugged terrain. Certainly, some increased costs could be incurred by individual permittees; however, the nature of the process used to arrive at these recommendations was such that those increased costs would not occur to the extent that it could be reasonably expected to reduce the viability of any one operation. Specifically the criteria for recommended wilderness under this alternative examined water sources, range fence, and other range developments that require frequent maintenance or access by motorized mean and adjusted boundaries to allow exclusion of these management concerns. No substantial reduction in the socioeconomic contributions provided through livestock grazing in the Gila NF is expected to occur as a result of these recommendations.

Alternative 3

Alternative 3 limits the use of prescribed fire to free up more funds to invest in mechanical harvesting treatments. Mechanical harvesting treatments focus on encroached grasslands and historically open-canopy woodlands. Naturally ignited wildfires are used to move toward desired conditions for natural resources at a similar level as alternative 1. Due to the emphasis on mechanical treatments, fewer acres can be treated overall. Mechanical harvesting typically has much higher cost per acre than prescribed fire.

This alternative is projected to result in a slight decline in range condition with a corresponding maximum decrease in AUMs of one percent. However, there is a stronger possibility that should favorable weather conditions occur, this decrease could be mitigated and existing AUMs maintained as opposed to alternative 1; a 1 percent decline in AUMs is more likely to be mitigated by weather than an 8 percent decline. There is also a slight reduction in the likelihood that infrastructure damage as a result of prescribed fire given that less prescribed fire occurs. However, the likelihood of damage associated with undesirable wildfire would remain similar to what it is currently, and the likelihood associated with wildfire managed for resource benefit is the same as alternative 1. This alternative has less potential to result in economic gains or losses, than alternatives 1 and 2 and stronger potential to maintain existing levels of management flexibility related to infrastructure condition.

Alternative 4

This alternative is identical to alternative 3 in terms of how mechanical harvesting, prescribed fire and natural ignitions are utilized. It is different in that it emphasizes timbered vegetation types rather than woodlands and grasslands, and primarily the timber types that also support livestock grazing. Model projections indicate a slight improvement in range condition is likely with a corresponding maximum increase in AUMs of 1 percent with weather conditions likely to exert similar influences as have been described. Effects to economic potential, and infrastructure and flexibility are the same as alternative 3.

Alternative 5

This alternative also restricts mechanical harvesting to the WUI and emphasizes the use of fire. Similar to alternative 2, it allows for more mixed-severity fire on the landscape and as a result, more of the forest moves to an open-canopy condition. Range condition is projected to improve, with a potential maximum increase in AUMs, weather permitting. Infrastructure damage is more likely under this alternative than any other, and are more likely to result in a cost to the affected permittees than alternative 2. However, similar to alternative 2, there are a lot of unknowns in how the trade-offs between improved range condition and potential increases in AUMs, and infrastructure damage might play out economically, both for the permittee and for the local economy.

This alternative also includes approximately 745,073 acres recommended to Congress for consideration as potential designated wilderness. These areas are identified in appendix F: Wilderness Process. Area boundaries were not adjusted for livestock operation considerations in this alternative. If Congress were to designate the areas recommended under this alternative, significant reductions in management flexibility and increases in operational and maintenance costs could reduce the revenue generated by the livestock industry the forest currently supports. The increased costs incurred by some permittees could threaten the viability of their livelihood.

Also under this alternative, for allotments without current NEPA analysis, whose permits have been waived back to the government without a preferred applicant, the allotment would remain vacant and unstocked until site-specific NEPA is completed to evaluate condition (e.g., any restoration needs) and issues (e.g., any wildlife conflicts) and to determine future management and uses. Depending on resource conditions and relevant issues, the NEPA decision could include closure, or partial closure, if resource conditions and circumstances warrant it. This would reduce management flexibility as compared to alternative 1 or 2, as it precludes the use of vacant allotments for any reason until a new NEPA analysis and decision are made.

Cumulative Effects

Lands adjacent to the Gila NF include the Apache-Sitgreaves NFs in Arizona, private ownerships and those under the jurisdiction of local or state government, and the BLM. The Gila Cliff Dwellings National Monument, under the jurisdiction of the National Park Service, is also adjacent to the Gila NF. Most, but not all of these lands support livestock grazing. The average rancher does not own enough private land to graze livestock on a year-round basis. Typically, ranchers require a private, state, BLM, or Forest Service grazing lease or permit to maintain a viable operation, and many ranchers have more than one. The ability to graze these lands sustains the economic viability of this traditional land use.

An apparent social trend, and perhaps a cultural shift being observed that may influence livestock grazing on lands under any jurisdiction is decline in the use of horses and mules for access and travel. More and more producers are opting for all-terrain, off-highway or utility vehicles for access and travel. While there are certainly exceptions to this trend, if it continues, remote allotments that contain designated wilderness or IRAs could become less attractive. As a result, there could be a reduction in the economic contributions the livestock industry provides to local economies.

Elk are abundant and management of their populations are and will remain under the jurisdiction of their respective state's Department of Game and Fish. They are important game species that generate a significant amount of revenue. Elk and livestock will continue to compete for forage and water resources for the foreseeable future. Similarly, wolves and other predators will to continue to prey on livestock when they have the need and opportunity. Wildlife conflicts and the economic costs they impose on livestock producers will likely remain a reality despite interagency efforts to identify and mitigate such conflicts.

Vegetation treatments that reduce the densities of woody vegetation are occurring and will continue to occur on lands of all ownerships. Whether intended for ecosystem and watershed function, fire protection, or forage production enhancement, these activities can potentially increase forage availability to support livestock grazing and protect investments in range infrastructure. Forage and water availability are still limiting factors, particularly during times of drought, and may become more limiting in the future as climate change progresses. This could potentially result in more land area being required to support the same number of animals, regardless of how the land is managed. This would reduce the quantity and quality of sustainable social, cultural and economic benefits provided by livestock grazing.

Herbicide-Use Environmental Consequences

The following discussion of environmental consequences addresses the effects of the herbicide-use alternatives on livestock grazing as a sustainable use of the forest.

Analysis Methodology

This is a qualitative analysis supported by the available published literature as cited in the text.

Effects Common to All Herbicide-Use Alternatives

All of the alternatives authorize the use of some herbicides on some number of noxious weeds. Noxious plant infestations can reduce the productivity of rangeland vegetation and threaten the ecological and economic viability of livestock grazing. While the species and populations currently known to exist on the forest are not substantially reducing productivity or threatening the sustainability of permitted livestock grazing, this could change in the future. While much remains undocumented or unknown, a few scientific analyses provide quantitative estimates of potential impacts.

In Montana, North Dakota, South Dakota and Wyoming, leafy spurge infestations in rangelands has cost approximately $130 million dollars and a loss of 1,433 jobs (Duncan et al. 2004). Russian, spotted and diffuse knapweeds in Montana's rangelands are estimated to be costing the state's economy roughly $42 million annually, which could have supported an estimated 500 jobs (Hirsch and Leitch 1996). These losses are associated with reduced forage production, as these noxious weeds are not palatable to cattle and/or have reduced nutritional content. When they replace native perennial forage species, the capacity of the range is reduced. At present, very few noxious weed species have been confirmed as present in the Gila NF, and populations are small enough that no measurable reduction in forage production, or economic contribution has occurred. However, this may not always be the case. Herbicides are in many cases, the only effective treatment for noxious weed species and thereby the only way to sustain the productivity of rangeland vegetation. Therefore, all of the herbicide alternatives provide some reduction in the risk of productivity loss due to noxious weeds. The differences between the alternatives are related to the degree to which that risk is reduced and the degree to which they address other threats to sustainable rangelands.

None of the herbicide risk assessments indicates the potential for environmental concentrations or durations that would be harmful to livestock, barring accidental spills (see appendix K). Project design criteria use the risk assessments and include a requirement for pesticide use plans that include measures to prevent spills and mitigate the effects if they occur.

Effects of Herbicide-Use Alternative A-No Action

Alternative A allows all noxious weed species on the New Mexico Department of Agriculture's noxious weed list as it existed in 2000, with the addition of tree of heaven, to be manually pulled or cut with a chainsaw and/or treated with herbicide. Fourteen different herbicides, all with Forest Service risk assessments, are approved for use, and all methods except aerial application are allowable. No new noxious weeds added by NMDA to the noxious weed list after 2000 are authorized for treatment and no native plant species may be targeted.

Alternative A does not fully support EDRR to noxious weed infestations or the maintenance of vegetation communities dominated by native species. The environmental analysis and decision-making process is time consuming and when new noxious species are introduced or discovered, time is usually of the essence. The longer noxious weed populations are allowed to persist on the landscape, the greater the risk of spread and the more area that may potentially need treatment. If discovered and treated early, eradication is more likely. If delayed, control or containment may be the only realistic goals, depending on the particular noxious species. This alternative does not facilitate rapid response to emerging threats and compromises management's ability to maintain the ecological and economic sustainability of livestock grazing as a use of the forest.

Effects Common to All Herbicide-Use Action Alternatives

Alternatives B, C, and D authorize manual removal and herbicide treatments on all noxious weed species listed on the most current APHIS, NMDA, or other state department of agriculture noxious weed lists. Any noxious plant species added to any of these lists after this environmental analysis and decision would be automatically authorized for treatment. Noxious species could be introduced from most places in the United States, and while the climate in the Gila NF may not be conducive to some noxious species now, it may be in the future. Waiting for state listing to authorize their treatment could limit EDRR and therefore, these alternatives support are more likely to support a successful EDRR program, promote maintenance of adequate vegetative cover and native diversity to protect soil functions, and promote movement toward and maintenance of desired conditions.

These alternatives also authorize the use of any herbicide with both an EPA and Forest Service risk assessment. As previously described under the same heading in the upland vegetation, fire ecology and fuels analysis, this does not change the potential detrimental effects anticipated as a result, but it does have potential beneficial effects as new herbicides with lower levels of risk could be registered in the future.

Effects of Herbicide-Use Alternative B-Proposed Action

Alternative B would also authorize the use of herbicide to control the density of native alligator juniper and evergreen oak species to accelerate progress toward desired conditions for vegetation communities and the WUI. Through the effects to vegetation communities and fire regimes described in the upland vegetation, fire ecology and fuels analysis, and by reducing the need for frequent mechanical treatments which effects were described in the analysis of the draft plan alternatives previously in this section, this alternative maximizes the potential for improved range condition and forage production the forest could support under a given draft plan alternative. Instead of repetitively treating the same site, new acres could be treated, opening up new areas and reducing the risk of detrimental fire effects as described previously in the analysis of the draft plan alternatives.

Effects of Herbicide-Use Alternative C

This alternative is identical to the proposed action in the way it addresses noxious weed treatments but does not include any treatment of native species. This alternative would not move as quickly toward maximizing the potential for improved range condition and forage production as the proposed action.

Effects of Herbicide-Use Alternative D

The effects specific to alternative D are similar to those of alternative B. However, the use of herbicide would only be restricted to the WUI, substantially reducing the benefits to permitted livestock grazing described for alternative B.

Cumulative Effects

Herbicide use limits the spread of noxious plants and allows for more acres of restoration, which maintains or improves range condition and sustains livestock grazing as a land use.

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